ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LX. No. 8. CHICAGO, SATURDAY, FEBRUARY 24, 1912. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
MARQUETTE BUILDING, CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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PRODUCTION COSTS IN SIMILAR GENERATING PLANTS.

On account of the differences in local conditions, engineers are rarely permitted to compare the performances of similar types of central stations undergoing steady expansion of service. In most cases considerable technical skill is required to ascertain why the operating results of diverse plants vary so widely. Analyses of this sort are generally suggestive, for they indicate to a degree at least the benefits and drawbacks of specific policies in station design and operation. When an opportunity arises to contrast the working of two plants of the same general character and size, useful lessons may still be deduced. Some figures of a year's operation recently assembled for two central stations located within 60 miles of each other and serving manufacturing populations with substantial power demands are therefore of particular interest, since the make-up of the plants, the number of men required to handle them, the cost of fuel per ton, and the proportion of motor output to total-energy sales are enough alike to warrant placing the results beside each other. New River bituminous coal is delivered at each plant by rail.

Plant A, rated at 2,339 kilowatts, operates a mixed generating equipment consisting of two 750-kilowatt, horizontal turbo-alternators and three engine-driven alternators with ratings of 100, 264 and 475 kilowatts. Eight engineers and firemen are on the payroll, and the cost of bituminous coal for the year at the station averages $3.87 per ton. Steam is supplied by six boilers of 1,350 horsepower, combined rating, all being of the water-tube type, hand-fired, with 140 pounds operating pressure per square inch. In plant B, rated at 2,300 kilowatts, two 1,000-kilowatt horizontal turbo-alternators and one 300-kilowatt engine-driven set handle the service. Ten men are on the payroll. The coal cost is $4.04 per ton. Four boilers, three of which are of the water-tube type, supply the steam, and the total rating is 2,150 horsepower, with hand firing in part. The steam pressure at this station is normally 150 pounds per square inch. The first plant serves a large number of jewelry factories and the second supplies numerous shoe shops with power, the day load being attractive in each instance. In station A the power-sales output for the year was 65 per cent of the total, and in plant B 61 per cent. In each case, the management is alert to extend the profitable service of the company, although no finan-

cial connection exists between the two organizations, which are entirely independent.

The results of a run of one year in each station show that plant A had a total output at the switchboard of 2,429,000 kilowatt-hours and B, 3,961,000 kilowatt-hours. The former's manufacturing cost was $28,713, or 1.18 cents per unit, compared with $45,138, or 1.14 cents per kilowatt-hour in the latter case.

No expenses of distribution, management, attorneys' fees, or fixed charges were included, the comparison being simply one within the stations and in no sense expressing the cost of delivering energy to the consumer on the distribution system. Briefly analyzing the foregoing costs, station A had a fuel expense of $16,450, or 0.68 cents per unit, and B had $25,439, or 0.64 cents per kilowatt-hour. The other heavy expense, labor, came to $9,399, or 0.39 cents per kilowatt-hour in plant A and $10,422, or 0.256 cents per unit, in station B. Of the rest of the items of station cost, the only significant one in the comparison was that of repairs, which was $2,000 in plant A and about $6,600 in station B. The yearly load-factor, expressed by the ratio of the average 24-hour output to the maximum, was 28 per cent in A and 38.5 per cent in B.

These results clearly show the benefits of large output upon the unit cost of labor, and indicate that here is to be found one of the chief opportunities for economical service in plants of moderate capacity which are required to meet the responsibilities of increasing loads. It is interesting to note the close relationship in unit fuel costs, substantially the same amounts of coal being required per kilowatt-hour in each instance. In most cases, such an increase in load as that indicated would be at once reflected in a substantial improvement in fuel economy, but it is not unlikely that the considerable difference in boiler capacity at the two plants may in part account for this. In plant A, the boilers are individually much smaller than those of station B, and unless the latter were handled at relatively high output, the economy of the larger units would not be always assured, taking the year from end to end. Each of these stations is in a transition stage from the reciprocating-engine type of design to the turbine installation. It is the practice of each management to carry as much of the load as possible upon the turbine sets, but at times it is necessary to operate the engines at partial loads for considerable periods. The figures given have often been bettered on the ground of station economy, but they point in a measure at least to the fact that similar causes produce similar results, even in the operation of that complex assortment of apparatus designated as a power plant; and they show what may be expected in average practice under specific conditions where turbines and compound condensing engines are run in fairly efficient combinations, for the conditions in these plants are quite typical.

ELECTRIC TRUCKS AND PROSPERITY.

The unabated demand for electric trucks in a great variety of industries marks a condition of affairs which may well give heart to the central-station man and to the manufacturer. It is a striking condition that this class of business is growing with leaps and bounds in the face of all sorts of hesitation in many other lines of production, and a deep and significant lesson may be drawn from it. The electric truck is succeeding because it is doing its share of the world's work better than any other agency handling a large volume of traffic at lower cost per unit than is possible with either gasoline or horses. There is always a field of usefulness for equipment which will perform a given quantity of work better than its predecessors, and at a reduced unit cost, and upon this great truth the electrical industry stands solid regardless of the fleeting opinions of politics, forthcoming presidential campaign influences and unrest in this quarter and that.

Consider the single field of electric-truck application to fire-department service. Only one city, Springfield, Mass., has gone into this to any extent as yet, but the results there are so favorable that it is said that inquiries are almost overwhelming in number from municipalities whose fire-protection boards are convinced that the days of the horse are past, and who are simply trying to decide between electricity and gasoline as motive powers. Almost daily the field of the electric truck expands to take in some new branch of manufacturing or mercantile transportation, and the volume of business in sight grows like a rolling snowball. And this is the trend of the economic situation regarding every form of electrical apparatus. It is imperative that the electrical solicitor see it and impress it upon his fellow citizens.

ELECTRIC STIMULATION OF ANIMAL GROWTH.

We have had occasion to call attention in these columns to the electric stimulation of vegetable growth and also to the claim for similar beneficial results upon children. Announcement is now being made in England that Mr. Thorne Baker has applied electric stimulation to the rearing of chickens with very successful results. His experiments appear to establish the fact that an electrified chicken is more energetic and active than those which have not been subject to the treatment. The details of the experiments are not yet available, but the treatment seems to consist of subjecting the chickens to an alternating field of high frequency with a potential of about 5,000 volts. The effect upon the chicken seems to be something like oxygen stimulation, and is free from any bad after-effects. The cost amounts to about one cent per month per chicken, which would be a good business investment if the final results appear as favorable as the present conditions indicate.

INSIDE WIRING IN DAMP PLACES.

Conditions of dampness within buildings so extreme that the moisture may affect the electric wiring are confined mainly to industrial or manufacturing plants of one kind or another, and in such plants the appearance of the circuits is usually a relatively unimportant matter. This latter fact is, of course, a point in favor of the use of exposed wiring here. Moreover, experience has shown that exposed wiring may be installed in such a way as to make it practically free from the effects of moisture, while more or less serious troubles have sometimes been encountered when other types of construction were tried in damp locations. Thus it is rather natural that many wiremen should be inclined to regard exposed wiring as the standard form of construction for rooms in which there is excessive moisture. In fact, practically every writer on electrical construction recommends this sort of construction unreservedly for the kind of service in question. An investigation based on the experiences of many large industrial plants employing open wiring on an extensive scale, however, will usually lead one to question the wisdom of the above attitude seriously, as the following considerations will show.

In many of such rooms as are subject to great dampness, the ceilings are quite low and also covered rather thickly, as a rule, with metal pipes used for various purposes. If the circuits are few in number and of small carrying capacity so that they can be installed directly on the ceiling itself, open wiring may possibly meet the requirements of the service and also prove satisfactory from the standpoint of safety and permanency. But this condition is by no means general. In very many of the larger plants circuits are required of such proportions as to make it necessary to support the conductors in some such manner as that employed in the so-called pin-and-insulator work, where the wires are run on glass insulators whose pins are installed vertically in horizontal cross-arms secured to the ceiling by means of suitable vertical supporting timbers. Systems of this nature, which, it may be well to explain, are very widely employed now, are liable to be rather seriously lacking in several qualifications highly desirable in an interior electric circuit. For instance, the circuits often take up more room than can well be spared for them; the element of mechanical protection for the wires is lacking; and there may be an unwarranted fire risk. Concerning the last of these three objections, it is to be noted that where work of this sort has been installed it is not unusual, unless some electrician or inspector is on the alert to prevent it, for steam fitters or plumbers in running metal pipes to leave some of these lying on top of the circuits where pipes and circuits cross each other. Moreover, if the ceiling is very low, a number of parallel conductors in the same horizontal plane affords a most convenient location for the temporary disposal of tools or other objects liable to cause short-circuits, and, experience has shown that careless employees are quite generally in the habit of using them. In fact, here is a case in which the construction appears to be about as faulty as that which might result from running conductors on the top of joists having an open space above them, to which electrical inspectors everywhere object.

In order to insure better protection for the circuits, a trough construction, in which wires are installed on knobs in inverted troughs made by fastening two boards together, normal to each other, and at an angle of 45 degrees with the horizontal, has been tried in many places, particularly in those rooms in packing houses where there is a great deal of water and water-vapor present. This construction, however, is not usually well adapted where a run of wires includes more than three conductors, and it is also more or less awkward and cumbersome wherever the circuit must cross a heavy timber or beam. Moreover, it is found that since there is nearly always condensation enough to keep the inside of the trough dripping wet most of the time, the protection of the circuit from water, which it has sometimes been supposed that the trough would afford, is a negligibly small, if not, indeed, a wholly imaginary quantity. A matter of still further importance in this connection is that the life of the trough is reported to be not at all commensurate with its initial cost.

The foregoing remarks indicate clearly that the matter of electric-wiring design for damp places is a problem for which an entirely satisfactory solution has not yet been obtained. The latest effort in this direction is evidenced by some experiments now being carried on in some of the larger packing houses in Chicago. The managers of these plants, annoyed by some of the disadvantages of open wiring referred to in the foregoing, and finding the cost of frequent repairs and more frequent inspections burdensome, have brokn away from the more or less traditional notion that conduit work is not at all suitable for wiring in damp locations, and are installing conduit not only in rooms where there is excessive moisture but also in places where there is both great dampness and a prevalence of corrosive vapors. It is a fact both interesting and important that reports from this work show that when proper care is exercised in running the lines the subsequent occurrence of short-circuits is extremely rare. It seems, in fact, that about the only thing necessary to make conduit entirely satisfactory, is the correct installation of fittings of the right kind and the provision of the necessary coating on the pipes to safeguard them against corrosion.

Indeed, even where no special effort has been made to prevent corrosion, the cost of repairs has been found to be low, compared with the upkeep of open wiring, while in other respects the service seems to be excellent.

Annual Banquet of the Pittsburgh Section.

The annual banquet of the Pittsburgh Section of the American Institute of Electrical Engineers held Saturday evening, February 17, in the large banquet hall of the Fort Pitt Hotel, was the largest and most successful ever held by that organization, over 400 members and their friends, many of whom were of the fair sex, being present.

An orchestra played throughout the evening, popular songs being interspersed and joined in by the audience, and the national anthem brought the crowd to its feet.

The speech-making was started by K. C. Randall, chairman of the local section, who, in a few well-chosen words, introduced the toastmaster, L. A. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company.

The guest of honor and first speaker was President Gano Dunn of the Institute, who responded to the toast, "The Electrical Engineer." President Dunn spoke of the wonderful accomplishments of the electrical engineer, and paid tribute to Pittsburgh, the Engineering City, and said that what it had accomplished was a great monument to engineering.

The next speaker was Dr. Hammerschlag, director of the Carnegie Technical Schools, who spoke on "The Value of an Expert," in solving general human problems. In the half century since Faraday discovered the principle of induction, there have been many changes and many duties devolve on the educational institutions which serve to encourage the growth of a truer and better life.

A. Leo Weil, president of the Voters' League of Pittsburgh, an attorney who has been very prominent in the civic improvement of the city, spoke on "Electrical Development in Modern Municipal Conditions." The speaker said that until electrical development became prevalent the city was regarded as a separate and distinct unit apart from human interests, but since the advent of the telegraph, telephone, and electric railway, light and power, the city has become a co-operative organization. He made an earnest appeal for electrical engineers to do something to counteract the baneful influences so prevalent in many modern civil governments.

The last speaker of the evening was H. E. Longwell, who proved to be the humorist of the evening, taking for his subject "Cultural Studies and Their Value to the Engineer." Mr. Longwell spoke of the value of Latin and Greek to the engineer and in a humorous vein mentioned many of the dead-language phrases familiar in engineering parlance.

The arrangements for the banquet were carried to very successful termination by K. C. Randall, chairman, and E. L. Farrar, secretary, assisted by the committee consisting of R. W. Atkinson, R. V. Bingay, R. S. Feicht, E. Friedlaender, S. P. Grace, and E. P. VanKirk.

Electrical Luncheon at Boston.

The fifth of the regular weekly luncheons of electrical men at Boston was held at the American House on February 16. L. D. Gibbs, of the Edison Electric Illuminating Company, Boston, presided, and an address on "Ornamental Street Lighting" was delivered by Harvey S. Tonks, of New York. About three hundred were in attendance.

Mr. Tonks, in his talk, advocated greater co-operation between central stations and local associations of merchants in the ornamental illumination of business streets, and pointed to the work lately accomplished in New Haven, Conn., as an example of the vitalizing touch of efficient methods. The company supplying the city with electrical service derives from ornamental lighting an income in excess of $16,000 per year per mile of thoroughfare illuminated. He did not feel that ornamental street lighting detracts from the effect of high-class window and sign lighting. A general plan of action was discussed whereby the small central station might gain the benefits of modern street lighting through the action of mass meetings and the installation of equipment along thoroughly approved engineering lines. Too much emphasis cannot be laid upon the importance of getting merchants to sign contracts on the front-foot basis at the initial meeting called to start the campaign. The company should be the final arbiter, however, of the designs and type of equipment to be used.

Meetings of Institute of Operating Engineers.

The Institute of Operating Engineers will be addressed at the meeting on March 5, by F. R. Low on "The Employer and the Operating Engineer." The meeting will be held at 29 West Thirty-ninth Street, New York City, at 8:15 p. m. The meeting on the evening of February 24 will be devoted to "Analysis of Coal," the speaker being A. E. Ellis. All interested in the subjects of these meetings are invited to attend and take part in the discussion.

At the meeting on February 6 a talk was given by W. D. Ennis on "Some Special Plant Records."

Electric Vehicle Section for Chicago.

As previously announced, a movement is on foot for the establishment in Chicago of a section of the Electric Vehicle Association of America. A petition signed by 16 active members has been forwarded to headquarters and the creation of the section is practically assured. The following members signed the petition: Anderson Electric Car Company, G. H. Atkin, H. M. Byllesby & Company, P. C. Chrysler, Commonwealth Edison Company, Cosmopolitan Electric Company, Cutler-Hammer Manufacturing Company, Edison Storage Battery Company, General Electric Company, W. J. McDowell, McGraw Publishing Company, Studebaker Automobile Company, United States Light & Heating Company, The Waverley Company, Westinghouse Electric & Manufacturing Company, Woods Motor Vehicle Company.

It is expected that W. H. Blood, Jr., the president of the Association, will be present at the inaugural meeting of the Section, which will probably be held some time in March.

The formation of this Section is largely due to the active part taken by W. J. McDowell, of the General Vehicle Company.

Wireless Station at Pittsburgh.

Plans are being prepared for the installation of the most powerful wireless-telegraph station in the country outside of those in seacoast cities, in connection with the completion of the new building for the departments of mechanical and electrical engineering at the Carnegie Technical Schools, Pittsburgh, Pa. The equipment will be up-to-date in every particular, and it is proposed to send messages which will carry to the wireless stations on the Atlantic seaboard.

Upon the installation of the station a course in wireless telegraphy will be added to the curriculum in the department of applied science. The new course will be in addition to the classes in telegraphy and telephony which now constitute a part of the prescribed courses in this department at the schools.

Car Lighting Club Holds Entertainment.

The February meeting of the Car Lighting Club was held in the rooms of the Western Society of Engineers, Chicago, on the evening of February 21, and was devoted to an informal dance, to which the ladies were invited. George Cravens attended to the entertainment features of the evening and the meeting was thoroughly enjoyed by all those present.

F. W. Smith.

To New York City is accorded the honor of having witnessed one of the earliest developments of the central station for the production of electrical energy for lighting and power. Not only has the great metropolis witnessed the beginnings of some of the most interesting things electrical, but the early electrical developments there have been a part of the training of the men who are today the most prominent in the electrical industry.

Frank W. Smith, the subject of this sketch, has been continuously identified with the electric lighting business in New york for a period of thirty-two years. His is a record of steady advancement, acceptance of increasing responsibility, and unfailing demonstration of capability.

Francis W. Smith,
Vice-President, United Electric Light & Power Company.

Francis Whitney Smith was born in Alden, Erie County, N. Y., June 22, 1867. As a lad he went to New York, getting his early education in the public schools of that city. In 1880 he became an office boy with the United States Illuminating Company. Three years afterward he was general clerk, and remained in that position until 1889. Then he became paymaster for the United Electric Light & Power Company. After two years he was made assistant auditor, and after remaining in that position for eight years he was elected assistant secretary of the company. A year later he was elected secretary of the Brush Electric Illuminating Company, of New York, and in 1905 he was elected secretary of the United Electric Light & Power Company. He has just been elected vice-president of the latter company, and will continue in the active management of the United Company's affairs as in the past under the title of secretary. He remains a director of the company, and is also secretary and a director of the Brush Electric Illuminating Company.

Mr. Smith is one of the best known central-station men in the country. He is a familiar figure at the conventions of the National Electric Light Association and the Association of Edison Illuminating Companies. He is a member of the Engineers' Club, The Friars' Club, the American Institute of Electrical Engineers, the New York Electrical Society, the Municipal Art Society, the American Museum of Safety, the National Electric Light Association, and the Electric Vehicle Association of America.

Telephone Rate Regulation.

At the meeting of the Electric Club, Chicago, on Thursday, February 15, an address was made by Frank W. Fowle on the subject "Telephone Rate Regulation." In the absence of the president, W. E. Keily occupied the chair.

Mr. Fowle discussed the influences which determine the cost of service in general, making a distinction between competitive conditions where the value of service usually fixes the price and conditions of a regulated monopoly, where the cost of service is generally admitted to be the proper basis of rates. He then analyzed the cost of telephone service and showed a rational system of rates should be based upon a proper conception of the elements which go to make up the cost of supplying service. The details of this analysis are given in an article by Mr. Fowle which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for December 9 and 16, 1911.

Costs may be divided into fixed and variable elements, the former including the expenses due to the individual installations and the common expenses of the general equipment. The variable part depends upon the amount of service demanded by the subscriber. The unit of service for a service charge should be the outgoing message, as it is neither equitable nor expedient to consider incoming calls. The claim that increase in size of the telephone system increases the cost per subscriber was refuted, it being shown that density of service reduces the unit cost in spite of the fact that certain elements, such as switchboard construction, are increased. The speaker advocated a minimum charge to which should be added a charge depending upon the number of outgoing calls, the latter to be determined by a meter on the customer's premises.

The subject of telephone rates has not received the attention and study which has been accorded to the rates for central-station electric service, and there was great room for improvement in present methods. The speaker then referred to the regulation of telephone rates which had been attempted in New York, Chicago and Los Angeles, and dwelt particularly upon the local situation in Chicago, where a third investigation is now under way for the purpose of determining the proper rates of the Chicago Telephone Company. He pointed out the great undesirability of rate regulation by local authorities and advocated regulation by a State Commission.

Max W. Zabel referred to one disadvantage which he thought must always exist under the conditions of a regulated monopoly. This was that no allowance was made for experimental purposes and the development of new methods of conducting business, and a Commission had no power to force a company to undertake such investigations. It is only under competitive conditions that such development is encouraged.

N. F. Obright made a motion conveying the good wishes of the club to Mr. Fowle upon his departure from Chicago to take up his new duties as associate editor of the *Electrical World* in New York City. The motion was passed by unanimous and hearty approval.

No meeting of the club was held this week on account of the meeting day, Thursday, falling upon a holiday.

The next regular meeting will be held on Thursday, February 29, at 12:15 noon.

American Institute Board Meeting.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers on February 9 a resolution was adopted giving power to the president and the chairman of the Meetings and Papers Committee to arrange for a joint meeting with the Illuminating Engineering Society.

The following associates were transferred to the grade of member: Albert M. Allen, Charles W. Pen Dell, Arthur L. Mudge, William C. Bauer, Walter E. Holland and Samuel Insull.

H. H. Barnes, Jr., and Walter S. Rugg were appointed as representatives of the Institute upon the Board of Trustees of the United Engineering Societies. These vacancies were caused by the resignations of Calvert Townley and Henry G. Stott.

Institute branches were established at the University of California, the University of Virginia and the Ohio Northern University.

President Dunn, Secretary Hutchinson, Charles W. Stone and Walter S. Rugg were appointed members of a committee to co-operate with the Institution of Civil Engineers of Great Britain towards erecting in Westminster Abbey a memorial window to the late Lord Kelvin. This action was taken at the request of the Institution of Civil Engineers, which invited contributions from members of the American Institute.

Alexander Graham Bell Made Honorary Member of the Telephone Pioneers.

At a meeting of the Executive Committee of the Telephone Pioneers of America, held in New York on February 9, Alexander Graham Bell was elected an honorary member. The secretary was authorized to present to Theodore N. Vail, president of the American Telephone & Telegraph Company, a group picture of the Pioneers suitably framed and with an inscribed plate. Action on the selection of a place for the next meeting was deferred. Those present at the meeting were J. J. Carty, Thomas D. Lockwood, Thomas B. Doolittle, Charles R. Truex and Henry W. Pope.

Vehicle Battery for Sick-Room Lamps.

Two physicians of Indianapolis, Ind., are making use of the batteries in their electric vehicles for operating electric lamps in the bed rooms of patients which are inadequately lighted. An outlet is provided on the vehicle where a cable can be plugged in and run through a door or window to the room of the patient. The physician carries a lamp and shade fastened around his neck, and a hand lamp is also included in the circuit. This scheme has been found very convenient where localized illumination is required for an examination in poorly lighted rooms.

Electroplating.

In a lecture recently delivered before the Sheffield Electro-Metallurgical Society on "General Preparatory Methods Previous to Electro-Deposition," A. Price said the demand for the electro-deposition of several metals, other than silver, had, during the past few years, increased to such an extent that the deposition alone of one metal—nickel—was responsible for the employment of more labor than all the other metals put together. In the several processes of metal coloring where certain desired finishes, known as oxidized and relieved, must be produced upon inferior metals, the need of a practical electroplater having a wide experience in the deposition of all metals upon al basis metals, became more important every day. Much information was yet needed in regard to the preparation of surfaces in order to secure anything like perfect adhesion. For want of knowledge the most skillful operator sometimes failed in producing adhesion, especially upon zinc, cast iron, steel, Britannia metal and high-percentage nickel-German-silver. Mr. Price explained the various methods adopted for dealing with different metals, and urged the importance of thoroughly cleaning all articles before immersing in the plating bath, else the deposit would not adhere.

The New Western Union Building in New York City.

The Western Union Telegraph Company is preparing to erect a 26-story building running from Dey Street to Fulton Street, in New York City. The present building, at the corner of Broadway and Dey Street, which has been occupied since 1874, will be torn down. The new building will not only cover its site, but will include additional space adjacent thereto. The first unit of the new building is expected to be ready for occupancy by May, 1913.

Date Set for Kansas Convention.

The annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association will be held at Manhattan, Kans., October 17, 18 and 19.

Further Electrification on the Pennsylvania Railroad.

The Pennsylvania Railroad is preparing to increase the trackage entering its terminal station in Philadelphia, the additional tracks to be used for electric service on the suburban lines. It is said that the work of electrifying the suburban lines will be pushed rapidly.

International Safety Congress.

The International Technical Congress for the Prevention of Accidents and for Industrial Hygiene is to be held in Milan, Italy, for five days beginning May 27. This is the first international congress of the knd ever held and will set in motion a world-wide movement for the conservation of human life in industry.

The American Museum of Safety, 29 West Thirty-ninth Street, New York, N. Y., is making preparations to see that the United States will be well represented. An American National Committee has been appointed and the congress will be attended by W. H. Tolman, director of the American Museum of Safety, and other members of the committee. Dr. Tolman will present a paper entitled "The Safety Engineer On a Large Transportation System." Among the other papers to be presented are one by V. R. Lansingh on "Proper Illumination and Accident Prevention," and one by Arthur Williams on "How the New York Edison Company Safeguards the Lives and Limbs of Its Employees." Among the 39 members of the American National Committee are the following: C. A. Doremus, V. R. Lansingh, C. O. Mailliux, T. C. Martin, L. R. Palmer and Arthur Williams.

Meeting of Philadelphia Section.

The regular monthly meeting of the Philadelphia Section of the Illuminating Engineering Society was held on February 16, at the Philadelphia Electric Company's Building.

J. D. Israel, chairman, presided, with 173 members and visitors present. 63 attended the dinner preceding the meeting.

A. J. Rowland opened the program of the evening with an educational talk on "Candlepower," this being the second of a series of five similar talks.

George A. Headley, of Swarthmore College, read the paper of the evening, "The Physics of Light," illustrated by lantern slides and demonstrations.

Upon motion of R. B. Ely, duly seconded, the following resolution was unanimously adopted:

"Whereas, the present standard symbols for electric wiring and gas piping on plans are inadequate for existing conditions and have not been universally adopted, particularly by the Illuminating Engineering Society,

"Be it resolved, that the chairman of the Philadelphia Section of the Illuminating Engineering Society appoint a committee of five members to consider plans for suggestions to, and conference with, the Committee on Nomenclature and Standards of the Illuminating Engineering Society, in order to bring this matter up for further consideration, leading towards definite conclusions and standards."

Electric Motors for the Operation of Farm Machinery.[1]

By Frank Koester.

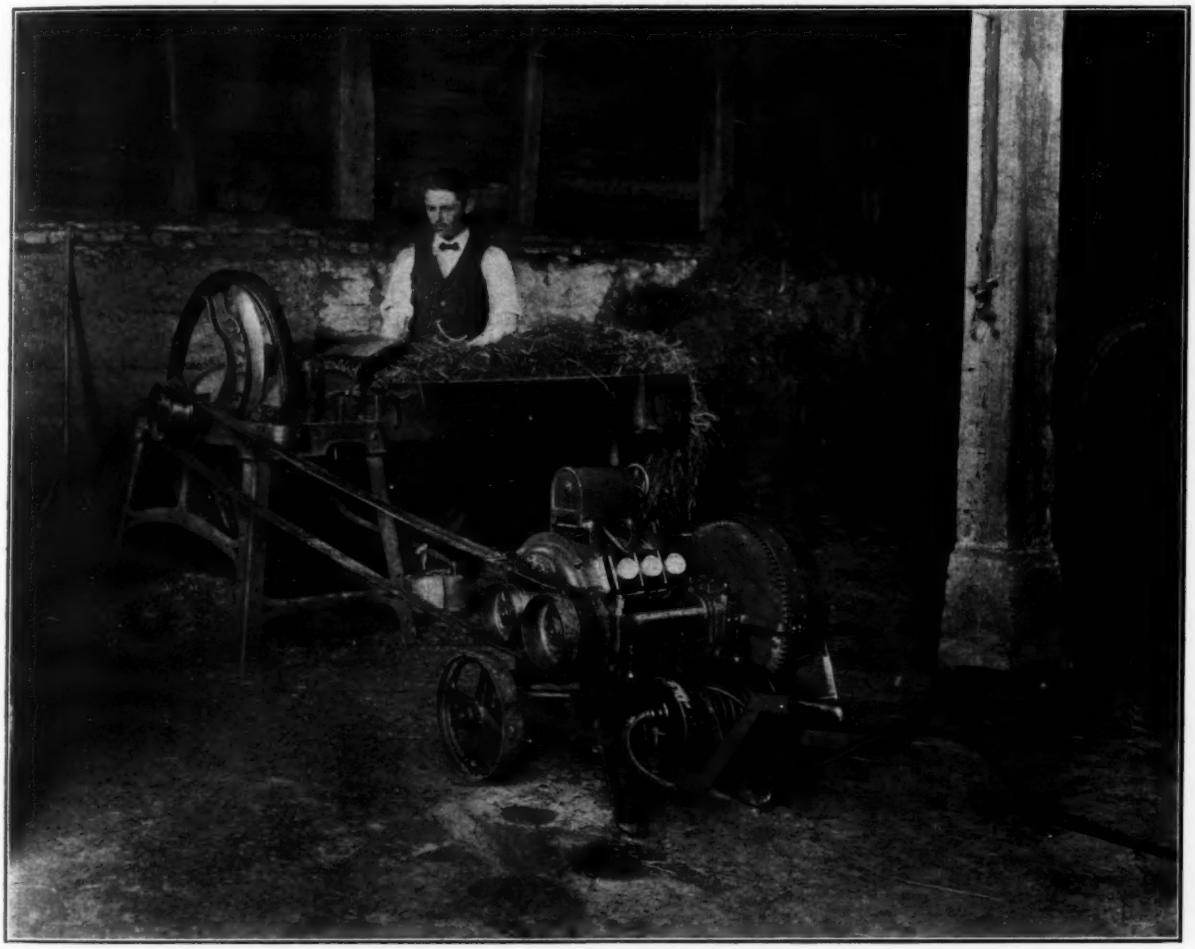
Small electric motors help to revolutionize the methods of doing many of the services connected with modern rural life. These labor savers have already been applied to machines for performing many tasks formerly done laboriously by hand. Almost any process that must be performed repeatedly with little or no variation can be done successfully and much more economically by a motor-driven mechanical device than by any other means. Electric motors in small sizes are rapidly passing from the class of luxuries into the class of necessities, and it is safe to say that within a few years small motor-driven machines will be doing the larger part of the routine work on the farm and in the homes, inns, shops, factories, etc.

These motors can be located in almost any place where current is supplied for electric lights and can be started and stopped as simply as turning an electric light on or off. A small motor-driven device can therefore be located with sole reference to the convenience of the work, the light, ventilation, etc., and with little regard to the source of power. An ordinary flexible lamp cord with a connecting plug serves to conduct the motor current for the smaller sizes from any convenient lamp socket, and the whole device, even while operating, can be moved about.

Perfect safety to the operator, to the motor and to the material being handled or the work being done is assured. All conducting parts are effectually covered so that electric shock is practically impossible. All moving parts, except a portion of the shaft necessary for driving, are so covered and protected that clothing or material cannot be injured. They are so extremely simple that almost any one, even the most inexperienced person, can operate them successfully.

Economy is also a consideration in favor of small motor-operated devices. Most people are surprised at the extremely low cost of operating a small motor. Many devices, which do more work than a full-grown person can do by hand, can be motor operated at a cost of not over one cent per hour. Moreover, current is taken only while the motor is operating, and the expense stops completely when the line switch is opened.

The question of economy also extends to economy of space, which is sometimes an important matter. Motor-operated devices occupy minimum

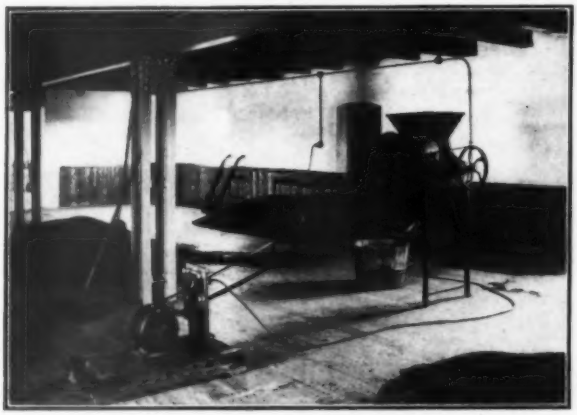


Straw Cutter Operated by Portable Motor.

1 Copyright by Frank Koester.

space, and the output of a farm can be materially increased by substituting them for older methods of driving. This substitution can often be made in preference to enlarging the space.

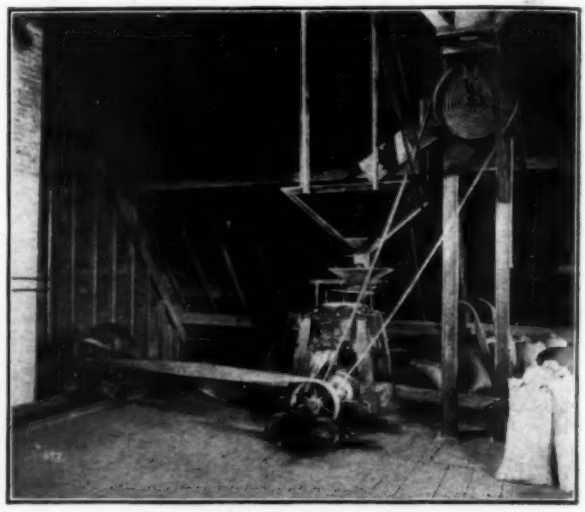
In many a modern country home the small motor has solved the servant problem either by making it possible to do without a servant or by making the work so pleasant and agreeable that good servants are glad to remain indefinitely. Small motors do the hard work, such as turning the washing machine and wringer, operating the carpet cleaner, floor polisher, dish washer, buffing and polishing wheels, etc.



Motor-Driven Corn Sheller.

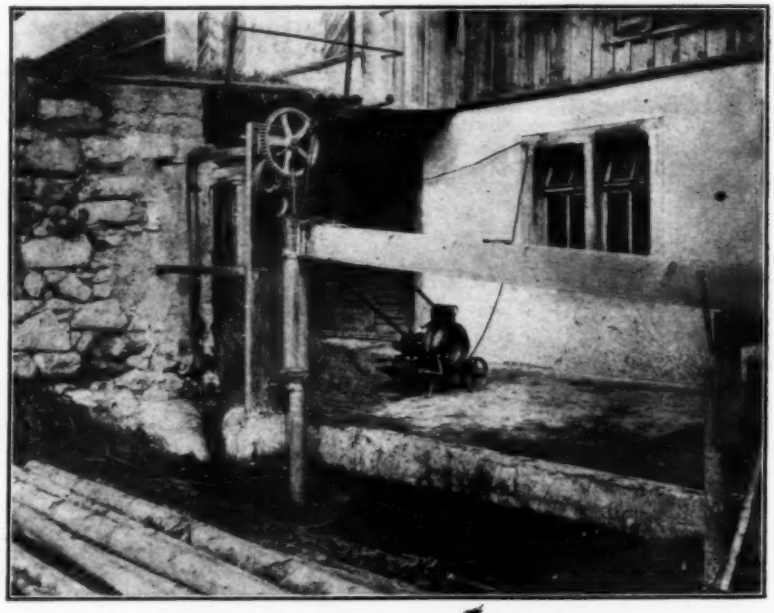
The sewing machine, a necessity in every household and formerly so trying to the strength of many housekeepers, can be operated with perfect satisfaction by a motor, and with practically no effort on the part of the operator except to guide the cloth. After having driven a machine by foot power and experienced the resulting feelings of weariness and possibly backache, what could be more agreeable than to have a motor do the work. The tiresome rocking motion of the treadle is no longer necessary; the motor takes all the drudgery, working quietly and tirelessly, one minute, one hour, or all day as desired, and all at surprisingly low cost. The control is perfect, much better than when operating by foot power, and is easily learned. Pressing a button or turning a small switch starts the motor easily as lighting or extinguishing an electric lamp. Slight pressure on the toe of the treadle starts the machine, and the speed depends entirely on the pressure applied, varying from a few revolutions per minute to full speed. A single stitch can be taken, or the machine can be run very rapidly, and can be stopped almost instantly.

Motors are extensively used for driving washing and wringing machines. The presence of such motor-operated machines in the household is a very material aid in solving the servant question, since they remove the more laborious and distasteful features of wash day. The power is secured from the nearest lamp socket and the cost of current for an ordinary family washing is only a few cents. The operation is extremely simple and can be readily learned by any one. When the clothes are in the washer and the cover is in place, a turn of the switch starts the motor. No attention is required, and since no rubbing is necessary, the clothes are not torn or injured. The power is easily transferred from the washer to the wringer, after which the clothes can be fed through the rolls.



Motor Driving Corn Mill and Corn Elevator.

In selecting a motor to drive a given machine, great care should be used to make the proper application. It is evident that too large a motor will make the outfit unnecessarily expeusive; while if the motor is too small, failure will result. The motor must be of proper size and must be adapted for the work in order to attain the most satisfactory results. The characteristics of the machine to be driven as well as the conditions under which it will operate must be carefully considered and a motor of suitable size and characteristics selected.



Cesspool Pump Operated by Portable Motor.

Small motors are demonstrating in a practical way the advantages of individual motor drive for small machines and are successfully operating thousands of labor-saving devices. The following is a partial list of machines

Motor-Operated Blower and Ensilage Cutter.

which can be advantageously driven by small motors. For many of these services no form of power other than electric motors could be used, and in no case could any other power compete successfully with small motors:

The General Utility Motor.

House pumps.
Churns.
Cream separators
Coffee and meat grinders.
Corn shellers.
Egg beaters.
Food-cleaning machines.
Potato peelers and other paring machines.
Sewing machines.
Washing and wringing machines.
Dough kneaders.
Emery wheels.
Hack saws.
Ice or refrigerating machines.
Polishing machines.
Dish-washing apparatus.
Ventilators and blowers.
Horse and sheep clippers.

Motor-Operated Washer and Wringer.

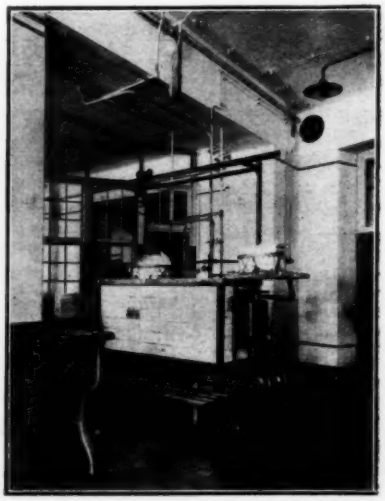
Various fodder-cutters.

Nearly all of the above mentioned machinery can be operated by portable motors, so that one or two motors (preferably of two different sizes) will suffice to run a dozen or even more machines at once. To facilitate application the motors, particularly those of small size, are placed on portable trucks or hand carriages; the latter arrangement makes it possible and convenient for the motors to be carried up and down stairs by two persons. Large motors, say above two horsepower, are best placed on a small hand truck, or on skids and transported from place to place, when they may be drawn by hand or horses.

With the motor goes a long flexible copper cable and a plug by which connection is readily made with the electric distribution system, through outlets located at convenient places.

Where it is possible to have several farming machines such as dairy apparatus, laundry machinery, blacksmith shop machinery, etc., located in a single room, it is best to operate all of them from a shaft driven by a single motor; leather belts being used to transport the power from the driving shaft to the several machines.

The accompanying illustration gives a striking example of electrically operated machinery in a dairy of a large farm. The first thing noticeable is the use of the group drive; the motor and starter being on the floor, are easily accessible; the shaft being on the ceiling and out of the way, it also serves to give the belts their proper length. As the motor and shaft have a fixed speed, and the various machines require different speeds, it is necessary to use various size pulleys in order to get the correct speed on each machine.



Motor-Operated Dishwasher and Exhaust Fan in Farm Kitchen.

As the period of operation of the machines differ, it is necessary to stop a single machine without shutting down the motor, thus stopping all machines. To avoid this each machine is supplied with an idler pulley which turns loose

on the machine or shaft; when the machine is to be stopped the belt is slipped on to the idle pulley and the machine comes to rest, while the belt continues to run.

Motors required for threshing and

Motor-Operated Washing Machine and Centrifugal Dryer.

other heavy machinery, are larger and heavier than the small motors. As the large threshing and other machines are located in various parts of the farm, for instance, in the yard and out in the field, the motors and starters are placed in wagons and hauled to the grounds by horses. As seen in the accompanying illustration, the motors are placed in a closed carriage, the pulley end of the shaft projecting through the side of the carriage. The belt is readily applied to the motor and threshing or other machines to be driven. A flexible cable is easily connected to a convenient outlet on the barn, or on a pole in the field.

A flexible and convenient application is that of a motor mounted on a horse-drawn truck. In order to get various speeds without changing the size of the driving pulley, a speed control box is placed in the wagon, and all that is necessary is to throw a handle to get the speed required within the capacity of the motor.

Similar to threshing and other farming machines which are shifted from one farm to another, a motor mounted on such a truck can be sent from farm to farm, thus saving expense; a community may own a single machine in common, or a progressive farmer may own one and rent it out.

Electrically Operated Milking Machines.

The history of cow-milking machines dates back over a century. Besides the United States, Australia and New Zealand are the two most prominent countries where real earnest work along the line of milking machines has been done, and at the present day these countries are second in the use of cow-milking machinery.

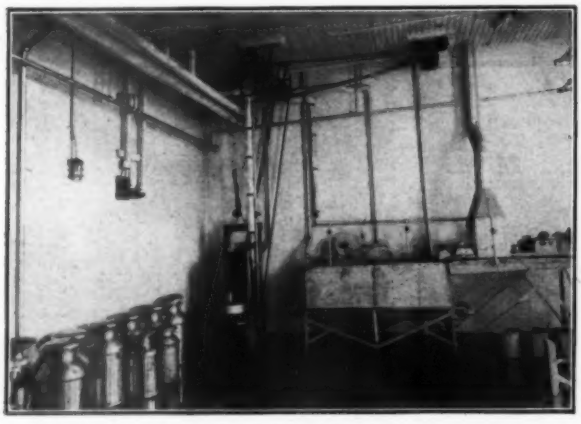
Professor Oscar Erf, a celebrated authority, states:

". . . The labor saved under practical conditions has been conservatively estimated to range from 30 to 40 per cent. Hence, more responsible men can be employed and higher wages paid . . . . . By the use of a milking machine the objectionable part of hand milking is greatly eliminated. The uncomfortable part of milking is the position in which the milker must place himself. The continuous open and closing of the fingers becomes tiresome. In the summer time it is exceedingly warm work and in winter it is cold, and in fly-time it is very disagreeable. By the use of the machine all of these objectionable features are eliminated . . . . Machine milking is cleaner than hand milking. . . . . In all cases milk taken from the milking machine remained sweet for a longer time, varying from one hour to ten hours longer than that obtained by hand milking . . . We have found that milking machines, if the vacuum is normal and the teat cups fit well, are more comfortable to the cow than hand milking. Some cows can be milked by milking machines that as a rule cannot be milked by hand."

Motor-Operated Cream Separator.

Professor Erf in his final conclusion says: ". . . A milking machine will milk cows as thoroughly as the average milker. Some cows give more milk when milked with a machine than when milked by hand. To reach the highest degree of success cows should be selected and bred to respond to machine milking. If this factor is taken into consideration machine milking will be equally as successful as the best hand milking . . ."

Professor Lane says: ". . . It has

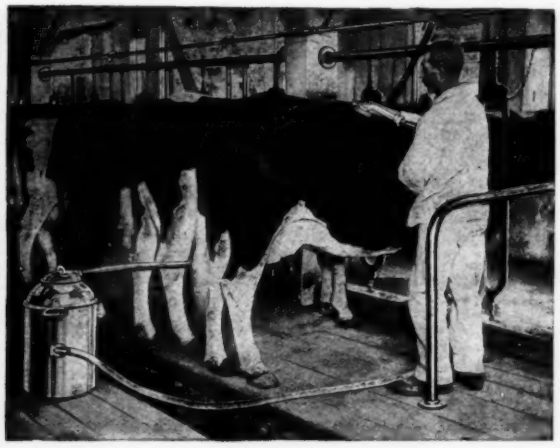


Induction Motor Driving Washer in Creamery.

Motor Driving Butter Machine and Other Dairy Appliances.

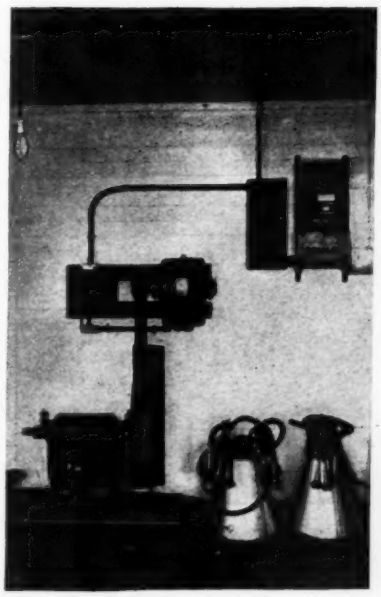
been long realized that a successful and practical cow milker would mean a profitable revolution of the dairy industry, as it would render the work of milking much easier and reduce the necessity for hired help, thus making the dairyman more independent. Efforts have been made by scores of inventors for more than half a century to construct a machine that would milk cows in a satisfactory manner and without injury. . . . A number of machines have been successful in extracting the milk from the cow by either pressure or by suction. . . . Naturally, inventors have attempted to imitate the way in which the calf sucks its dam. The difficulty has been to reproduce the peculiar influence which the sucking calf has upon the cow and to devise a machine which will not irritate the animal and which will do its work without injury. Another difficulty in devising a cow milker has been to construct it so that it could be adjusted to all cows. Individual animals vary greatly in the size and conformation of their udders, and even the same cow varies somewhat in the size and shape of her udder and teats during the different stages of her lactation period. Cows also vary greatly in disposition and temperament. A successful cow milker, therefore, must meet all these different conditions Since milking must necessarily be an artificial process, it has been thought for some time that animals would become accustomed to being milked by machines just the same as they became accustomed to hand milking, provided a milking machine could be perfected that would be comfortable to the animal when in operation. A heifer, for example, coming into milk the first time, would take as readily to one artificial method as to another, other things being equal. . . ."

Milking With Vacuum Machines.



Vacuum Cattle-Cleaning Machines.

Professor Lane, describing experiments he carried out on milking machines, states farther on: "One good careful man or woman can operate four machines milking eight cows simultaneously, and an additional hand can not only carry away the milk, but can assist in manipulating the cows' udders. The operating expense of the machines is comparatively small. . . . . One man has milked 60 cows on more than one occasion, the time required being two hours. If, however, we include the time of the man who removed the milk and assisted in manipulating the cows' udders the saving in time is reduced one-half, or 58.45 minutes per day for the 10 cows. These figures furnish sufficient proof for the statement that the machines are time savers.



Motor-Operated Vacuum Pumps and Milking Outfit.

Naturally the large dairyman will be the first to adopt the cow milker for the reason that his equipment will cost him less per cow than the small dairyman. Again, the large dairyman has more at stake and has to depend entirely upon the hired men to do the work. If they fail him the work falls upon himself or perhaps upon a very limited number of helpers. With the installation of the milking machine the large dairyman is much more independent, and if necessary could milk a herd of 50 cows without assistance. This would be next to impossible without it. However, there seems to be no good reason why a dairyman with a herd of even 10 or 12 cows could not use a machine with profit.

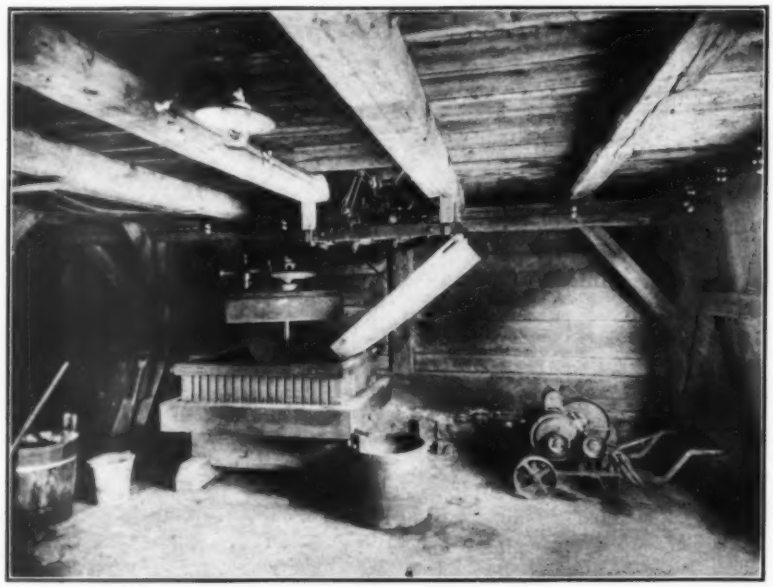
One of the most successful milking devices consists of two parts, one being the milk can or receptacle, and the second the milking machine. The milking machine consists of a cover which fits air tight on the receptacle by means of a small rubber gasket. Mounted on the cover is a frame, a pair of vacuum pumps and a pair of double valves. The pumps are operated through a crank shaft by a small electric motor of one-sixth horsepower. Operatively connected with the crank shaft is a drive which puts the double valves into motion. On one side of the frame is a small vacuum gauge which indicates the degree of vacuum created in the can. Beneath the vacuum gauge is a needle valve by means of which the degree of vacuum desired to milk the cows can be exactly regulated. The double valve is equipped with a stop-cock on which is fastened a rubber tubing about three and one-half feet in length, a transparent and flexible connection with shut-off clippers to a pair of teat cups carrying pneumatic cushions.

Cost of Operating Electric Farm Machinery.

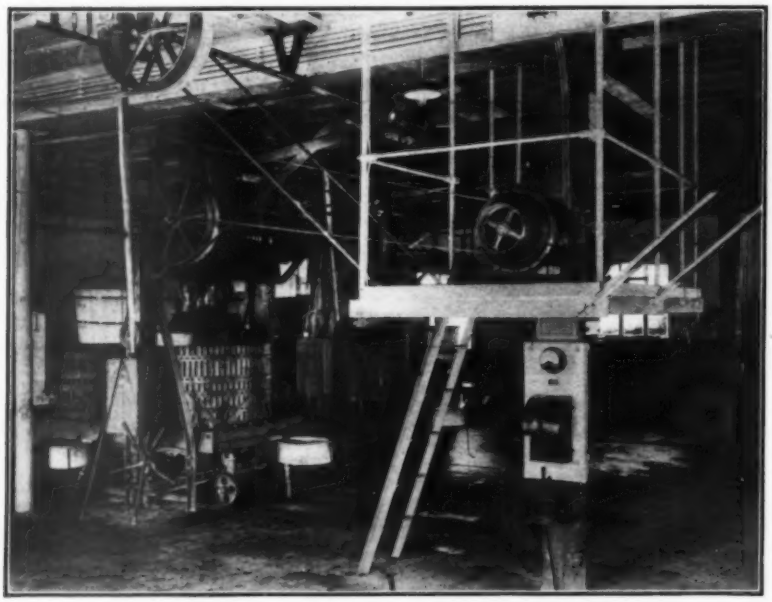
In order to give in concrete form an estimate of the amount of electric energy necessary on a farm, the average

figures from a 100-acre farm are given. It is assumed that two-thirds of the products are of a stalk nature, and that to the farm belong three horses, ten cows, and some fifteen swine and sheep, etc. The figures are not fictitious, but taken from actual experience, from the average of a number of farms. It is also assumed that electric energy for power purposes is five cents per kilowatt-hour, which is a reasonable figure for current used for power only, when purchased from a public-service corporation. When the farmer controls his own isolated plant the cost of electric current varies and may be less than when furnished by an outside plant; be as low, in some specially favorable cases, as one or two cents per kilowatt-hour.

The water pump is the most necessary part of the farm equipment, and in nearly every case is the first to be operated by electrical energy. The average water consumed on a 100-acre farm is as follows: for the house, per head per day, 5 to 6 gallons; for cattle, from 12 to 15 gallons per head; for swine and sheep, 1 to 2½ gallons. For pumping 1,000 gallons to a tank elevated 35 feet the power necessary is about one-half-kilowatt-hour, at a cost of 5 cents; so that the yearly average energy for 3 horses, 10 head of cattle, and 15 swine and sheep is about four dollars.



Fruit Press Operated by Portable Motor.



Fruit Press Operated by Stationary Motor.

The threshing machine, of the smaller sizes, is capable in ten hours of threshing, cleaning and sacking, ready for the market, 80 to 200 bushels, 3 to 5 electric horsepower being required. For machines of from 160 to 240 bushel capacity, 5 to 7 horsepower are necessary; for 300 to 800 bushels, from 10 to 20 horsepower are required.

The energy required for the various products to be threshed and cleaned, per 100 bushels, is, for rye, 25; wheat, 22; oats, 19; barley 21 kilowatt-hours, or on the average of 22 kilowatt-hours costing $1.10 or at the rate of 1.1 cents per bushel. If hay-baling machines are attached to the thresher from 4 to 6 additional horsepower are required.

Motor-Operated Potato Peeler.

Fodder cutters, varying from 1 to 2 horsepower, consume per 100 pounds of fodder, one-eightieth kilowatt-hour, costing one-sixteenth cent, and as 10 head of cattle consume per year 60,000 pounds of cut beet, etc., the total yearly cost for the energy used to operate the fodder machines is about 50 cents.

One of the by-products of cottonseed or linseed oil mills is sold as meal or as cake, and for the latter a special machine is needed break them up; such a machine has a capacity of 2,000 to 3,000 pounds per hour. The average food per head of cattle is 2 to 3 pounds per day, which amounts, for 10 head, to about 9,000 pounds per year. The cost of electric energy for operating the machine is 25 cents per year.

As the cattle are fed from 2 to 3 pounds of crushed grain per day per head, and as there are 10 altogether in

the 100-acre supposition, a motor-driven grain crusher is needed, for crushing 9,000 pounds per year. This quantity could be crushed at one operation, with a correspondingly large mill; for the purpose at hand a motor varying from 3 to 5 horsepower, according to the size of the mill employed, will do the work conveniently. To grind 100 pounds costs 3 cents for the energy consumed, or for the total 9,000 pounds $2.70 per year.

For running cream separators a small motor, about one-quarter horsepower, can separate 300 quarts of milk per hour, consuming 0.3 kilowatt-hour, at an expense of one and one-half cents. As the average production for 10 cows is about 30,000 quarts per year, the yearly cost for operating the separator on this basis is $1.50.

A churn for 300 quarts of milk, assuming average conditions, requires from one-quarter to one-half horsepower as also does the butter kneader.

By-Products With the Use of Electricity.

Similar to the rural central-station idea of supplying a number of farms combined with electric energy and ice, the farmers in a community may combine and erect a plant for taking the surplus of vegetables, fruit and other plants, and converting them into various forms of by-products. Where the central station is steam or gas operated, the idea of drying leaves of beets and potatoes for cattle food, and the drying of potatoes later described, can be conveniently carried on.

The idea of utilizing farm refuse for by-products must not be discarded without close study and consideration; it must be borne in mind that our modern industries make use of all possible substances for by-products. In thousands of cases it has turned out that the by-product has proven more profitable than the original, and practice has always shown that this applies proportionately to rural industries and farm.

Many of the products of the farm which are now allowed to go to waste could be turned to good account by the use of electrically operated apparatus, especially designed to turn by-products into marketable goods.

Nearly all fruit is rich in sugar, varying in contents from 5 to 10 per cent. Of the common fruits, the grape yields the largest percentage of sugar. The normal wine-grape contains from 16 to 30 per cent, with an average of 20 per cent. The two most important plants for yielding sugar, are the sugar cane and sugar beet. For instance, the Louisiana sugar cane contains 19 to 40 per cent of sugar, while sugar beets contain from 12 to 18 per cent of sugar. Sorghum contains, in the stalk at the time the seed is matured and the starch hardened, from 9 to 15 per cent of sugar. Indian corn contains from 8 to 15 per cent, according to the report of the United States Department of Agriculture.

In packing fruit for market, such as apples, grapes, etc., only sound fruit is selected; that which is in any way bruised or in the first stages of decay, is thrown out. Instead of allowing this refuse to go to waste, it can, by the use of electrically operated presses, or stills, be turned into cider or grape juice. The pumice which remains can be used as fertilizer for the soil. The amount of electric energy needed to operate the machine necessary for such purposes, is much less than five horsepower; one of the portable motors used for various purposes can take care of these outfits during the time it is in operation.

Farm products from which starch may be obtained as a by-product are the potato and cassava. The American potato contains 15 to 20 per cent of starch, which in turn may be converted into alcohol. In many instances potatoes are accidentally exposed to severe cold frosts and are frozen or are sometimes frozen in storage. In Europe potatoes in such condition are of some value, yielding a considerable percentage of alcohol of high strength. This practice of converting frozen potatoes, into alcohol is common abroad.

Recent German reports, in bringing out facts on electrically operated farms, show that since the engineer has worked in harmony, and especially since the government has taken active interest in the matter, a number of plants have been installed for drying the leaves of the potato and the beet, to be used as food for cattle, because they are high in portein or fat-producing elements; Germany used to buy $8,000,000 worth of cattle food from foreign countries. The records show that there are yearly twenty-four million tons of green leaves for drying, giving about six million tons of preserved food-stuff at a cost of nearly $12,000,000.

Since 1909 the output of distilleries in Germany has been cut down, and 300 plants have been installed for drying potatoes. It might be of interest to state here that the annual yield of potatoes in Germany amounts to some fifty million tons. When put into bins for storage their value shrinks about 10 per cent, with a loss of approximately $25,000,000. The process of preserving potatoes is washing, drying, peeling and cutting into cubes, and again drying.

There are many vegetables and plants grown on the farm which can be converted into one form of by-product or another, especially for the manufacture of alcohol. There is over twenty per cent of starch in the South Carolina sweet potato, and as high as 2,600 pounds of starch per acre has been produced.

The average yield of sweet potatoes per acre is of course much less than in the above cited South Carolina case, where heavy fertilization was practiced. On plots to which fertilizer was not added, the yield was about 8,000 pounds of sweet potatoes per acre, yielding, in round numbers, about 1,900 pounds of starch. The quantity of sugar in the 8,000 pounds is about 350 pounds, which makes about 1,250 pounds of fermentable matter which can be turned into industrial alcohol, yielding about 160 gallons of 95 per cent proof.

Annual Report of the Commissioner of Patents.

The annual report to Congress made by Commissioner of Patents Edward B. Moore has been made public. It shows the business of the United States Patent Office for the year ended December 31, 1911.

Last year there were received 67,370 applications for mechanical patents, 1,534 applications for design patents, 217 applications for reissues of patents, besides several thousand applications for registration of trade-marks. labels, and prints. 33,927 patents were issued, including designs, 157 patents reissued, and 4,205 trade-marks, 659 labels, and 248 prints registered. The number of patents that expired was 19,875. The total receipts were $2,019,388.03, the expenditures $1,953,689.91, and the surplus of receipts over expenditures $65,698.12. The total balance to the credit of the Patent Office in the Treasury of the United States on December 31, 1911, was $7,063,925.76.

There have been gains in efficiency and economy in the work of the Patent Office. The work of a comprehensive classification of all patents issued to date is well under way; the magnitude of this undertaking can be appreciated when it is known that the total number of patents issued in this country from the origin of the Patent Office to the beginning of this year is 1,023,051, whereas there have been issued in all the foreign countries about 2,242,000 patents before 1912.

Mr. Moore again urges the enactment of legislation to facilitate the work of the bureau and to make it more reliable. Among the laws desired is one to eliminate one of the appeals within the Patent Office, one requiring that two photographic copies of each drawing shall be filed with each application, one to legalize the issuance of certificates of correction, and one to compel more rapid prosecution of applications.

Commercial Practice
Management, Rates, New Business

ELECTRIC ADVERTISING.

By Robert Montgomery.

Mr. Montgomery is contract manager for the Fort Worth Power & Light Company. He delivered this address to the Fort Worth Advertising Men's Club at a luncheon last month, with stereopticon illustrations. As a result, electric-sign lighting has been noticeably stimulated in the city of Fort Worth.

In order to appreciate the value of electric advertising, it is necessary to look behind the application and at light itself. Light has a fascination for the human being that has exhibited itself in a thousand ways since the world began.

Men have worshiped fire, the sun, the moon and the stars, and just as darkness has typified sin and wretchedness, light has always been associated with good and cheer. It appeals to us, makes us light-hearted, and spreads the spirit of contentment. Each man knows that for himself, else why should he gaze into an open fire when the logs are blazing, and why should the myriad lights of "Coney Island" or the "White City" affect him as they do?

The outline lighting of the Pan-American Exposition "made the tongue of the whole world wag," while the outline lighting of the Hudson-Fulton Exposition was the only feature that was worth advertising. Our modern display lighting is not simply a scheme of decoration, it is a humanizing influence that makes direct appeal to our inherent love of light. It is in effect a subtle personal appeal to every man, woman and child, because, by nature, they love the light.

And so men have come to recognize this alluring power and shape it to effect their ends. No modern World's Fair would be complete, nor could it win popular favor, without those marvelous triumphs of illumination that make every massive hall and tower stand out like a fairy land. The great feature of such functions as the recent Knight Templars' Carnival in Chicago is always the electric lights that outline the buildings, festoon the streets, and sparkle from countless signs. The climax of water pageants is always the night illumination of the ships; the "Luna Parks" and "Dreamlands" could not live a night without their sparkling lights, for that is what lends the carnival spirit, which opens our hearts and pocket-books.

And to invoke this same carnival spirit, to put this appealing influence of light in commercial harness, merchants and business men are joining hands, in town and city, to make the shopping district bright and cheerful at night. They are lining the curbs with flaming arc lamps, or spanning the street with arches of incandescent lamps, or installing ornamental iron lampposts, bearing soft glowing lights, that create an immediate attraction to young and old. And because of this subtle influence of light, such decorative lighting systems bring out the people in the evenings, to walk the bright, cheerful streets, and where the crowd walks it spends money. For, in the evening, we have laid aside our business cares and are easily impressed; the merchant's window display stands out clearly in the brightly lighted window, and we see much that we want and buy. The influence of light is creating business for those merchants.

Since the advent of the new four-candlepower Mazda lamp, which consumes only five watts, it is possible for a building to be illuminated with outline lighting for one-third the cost of electricity as compared with the old-style carbon lamps, and at the same time, a whiter and better light is produced.

You have a good illustration of the effect of light upon traffic here in Fort Worth. Take a walk down Main street and back on Houston, and you will notice that the density of the crowd varies almost in proportion to the intensity of the illumination.

When a merchant buys advertising space, the first question he asks is "What is the circulation?" thereby gauging the value of his ad by the number of subscribers to the publication. If this same merchant gauged his window advertising the same way, he would use twice as much light in his show window, because a well lighted, attractive window will reach a larger circulation and sell more goods than any advertising medium at the same cost.

Passing on to the subject of electric signs, which is the most important factor in electric advertising, I will say, that as near as I can find out, the first electric sign was made in the year 1882, by W. J. Hammer, in New York City, then chief engineer of the English Edison Company. It was placed on the organ in the concert room at the Crystal Palace during the International Electric Exhibition of 1882. The name "Edison" was flashed out by means of a spring switch. Only a dozen years ago, the illuminated sign was a curiosity, as New York had only a score of them, and Chicago even less; today the number of these signs in the two cities run into the thousands, and many of them contain many thousands of electric lamps.

In designing electric signs, it should be borne in mind that they are first, last and always an advertisement, and the success of a sign depends upon with what degree the designers have kept this fact in mind. The most important thing in building an electric sign is to have it in harmony with the business it is working for. That's what makes the difference between "just an electric sign" and electric advertising: the sign must have the spirit of the business to represent that business as a salesman. It must do more than simply make a forceful and far-reaching impression, it must make the right kind of an impression.

Artistic design is the next thing to consider. Electric signs have not only all the colors, but they have the one great quality which artists have always sought, the quality of light. On this account they should be more artistic than painted signs. It is well for the man who is erecting a sign to give his own ideas, for most merchants are clever and original in laying out attractive advertising ideas.

Several more large signs for Fort Worth are now under construction, and will be erected very shortly; among them is a large flashing sign for the Walk-Over Shoe Company, and a very attractive animated sign for the

Beacon Shoe Company; also one for the Armstrong Packing Company, containing about 700 lights.

The Fat Stock Show will take place in March, the Ad Men will be here in May, and thousands of K. of P.'s will be here to attend their national convention in August. We will have more visiting strangers in our city in the next six months, than will probably be here in the following three years. Each one of them will be a walking advertisement for our city if he receives the proper impression while here, and there is no doubt that well illuminated show windows, outline lighting and electric signs, will give the impression of a wide-awake and prosperous city.

I have given the order to have outline lighting installed all over our office building, at Ninth and Commerce Streets; I am also going to install at once, "White Way" posts about 15 or 20 feet apart around the building, so if any one wants any data about the cost of outline lighting, and the method of doing it, I will have a sample job for you to look over.

In conclusion, I will say, that if any one in Fort Worth has any intention in the near future to install outline lighting, or an electric sign, now is the logical time to do it, before the three big events I have mentioned take place, when we can send thousands of boosters back to every state in the union with the impression that Fort Worth is not only the most progressive city in Texas, but for a real wide-awake, live town, it has no equal for its size, any place in the world.

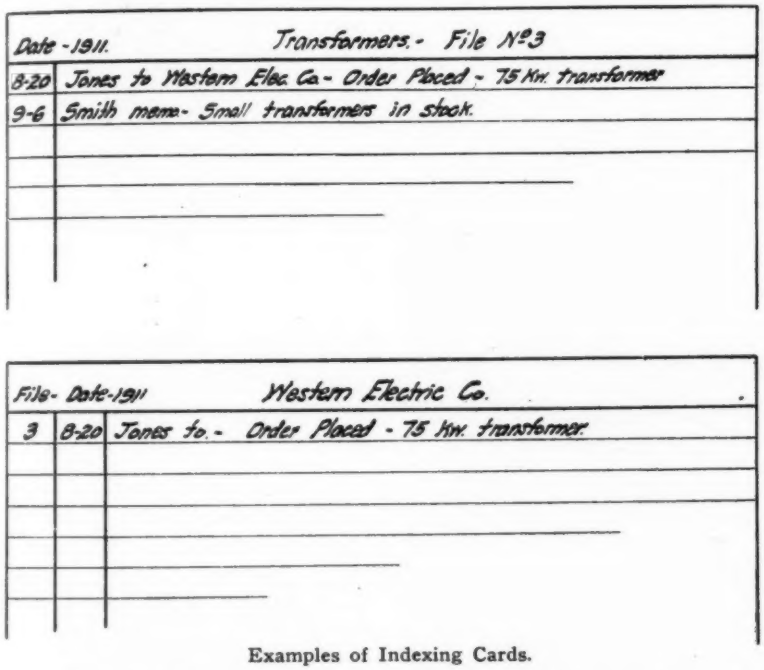
Correspondence Filing System for Lighting and Power Industry.

The accompanying method of filing correspondence, employed by a large public-utility company, has proven effective in affording the material essentials of an adequate filing system—accuracy and rapid reference with minimum labor—and is especially adapted to the particular line of endeavor. Dividing, as is customary, the various departments of the business under distinct classifications, such as generating department, line department, meter department, and the like, each maintains an individual correspondence file relating to its function, covering all letters, whether directly between such different offices or foreign.

Correspondence is filed and referred to by a numerical system under the subject matter, that is, each subject is given a specific number and such adhered to. For instance, in the line department subjects are listed as: (1) Transmission Lines; (2) Line Extensions; (3) Transformers; (4) Motors, and so extending to include each phase of the province of the office, which necessarily has its limits for such segregations. An index card, four inches by six inches, is listed accordingly for reference, offering a key to the entire system.

All letters relating to a particular topic, regardless of purpose, whether for material in stock, material used for construction, material purchased, etc., are given the respective number as indicated above; this is noted on the matter in blue pencil. Correspondence is placed in heavy paper folders, on which are marked the subject and its number, and filed in vertical filing-cabinets.

Coincident with the filing of a letter, record is made on cards, of the size as mentioned, under two headings, subject and name. The former corresponds with the classification of matter as made on the general index card, being "Transmission Lines," "Transformers," or as may occur. On the "name" card the name of the firm or person serves as the key for reference. On these cards the index number is recorded, date of letter noted in margin and brief entry of subject matter made. The accompanying illustration affords an example of the indexing in both instances.


Date - 1911. Transformers. - File No. 3
8-20 Jones to Western Elec. Co. - Order Placed - 75 Kw. transformer
9-6 Smith memo - Small transformers in stock.
File - Date - 1911 Western Electric Co.
3 8-20 Jones to. - Order Placed - 75 Kw. transformer

Examples of Indexing Cards.

The cards are kept in proper order under number for subject index and alphabetical sequence for name classification in card index file. The cross-indexing insures against the loss of correspondence reference, or the information contained in each respective communication. The subject number is always placed on the letter at the time of making card entries to provide against a repetition of listing, should correspondence be taken from the file and held for any period of time.

The efforts demanded to competently effect the method described may be slightly greater, initially, than is required with a loose system of providing for such matters. In acord with potent worth rendered, however, affording any particular correspondence exactly when needed and other similar advantages readily noted, there is no comparison.

Electricity Supersedes Gasoline at Municipal Water Works.

The city officials of Whitefish, Mont., recently agreed to a proposition from the Northern Idaho & Montana Power Company to let the latter install a 25-horsepower, three-phase motor to displace two 25-horsepower gasoline engines, at the municipal water works, on a test for 30 days.

The motor proved to be more economical and satisfactory in every respect, and permanent arrangements for the purchase of power were made. The motor is controlled automatically with a remote float switch operated by a relay.

The electric company states that the city will save enough by the change to pay off the entire additional investment in 12 months.

Expansion in Fort Worth.

The new million-dollar power plant of the Ft. Worth Power & Light Company of Ft. Worth, Tex., is rapidly nearing completion and will be ready for operation about August 1.

Electrical Construction

NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

This is the eighth of a series of articles on electrical construction, treating in a thoroughly practical manner every phase of construction usually encountered by the electrical contractor or the electrician in an industrial plant. This article discusses in detail the installation of generators.

The Generator or Dynamo.

The electric generator or dynamo consists essentially of two members, and these are commonly known, respectively, as the field and the armature. Electric current is obtained in the operation of this machine by the rotation of either the armature or the field by means of some external source of power, such as a steam, gas, gasoline or oil engine. Alternating-current generators are often called alternators. Turbo-generators consist of a dynamo on the same shaft and bed plate with a steam turbine, and the steam turbine drives the dynamo. In hydroelectric plants alternators are driven with water turbines or waterwheels.

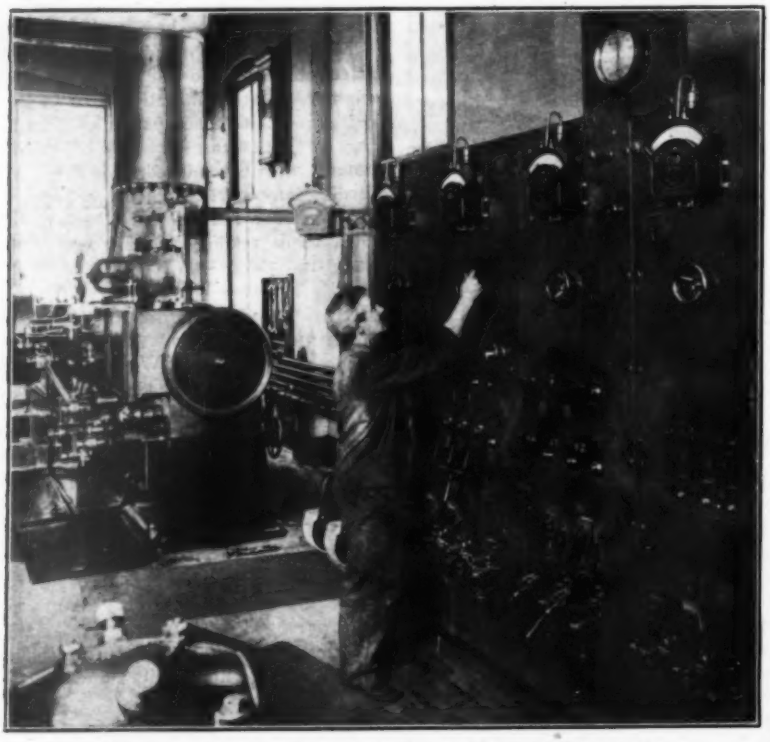


Fig. 1.—Showing Attendant Operating Field Rheostat.

Direct-current generators are usually self-exciting, which means that current from the dynamo itself is employed to magnetize, or excite, its own field poles. But for magnetizing the field poles of the alternator a separate exciter is used, the exciter being a relatively small direct-current dynamo. Exciters in alternating-current plants are usually machines designed to be operated at voltages of about 125.

Generators are wound for different voltages. In the majority of direct-current power plants—except those which supply service to street railways—the dynamos used are built for some voltage between 105 and 250. Alternators, however, are wound for voltages much higher than these, 2,300 volts being the pressure very commonly employed in the smaller alternating-current central stations. It is necessary to explain, though, that these statements concerning voltages apply to what are known as constant-potential generators; that is, to machines in which the voltage is always practically the same during operation. There is

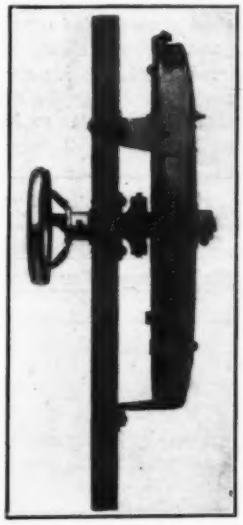


Fig. 2.—Field Rheostat—Rear-of-Board Type.

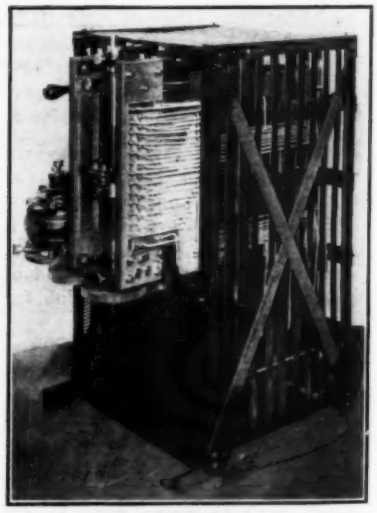


Fig. 3.—Rheostat Designed for Remote Control.

a type of dynamo, used to some extent in the operation of series street-lighting systems, in which the current supplied to the load is constant and the voltage is adjusted automatically to the number of lamps burning. This type of machine is therefore styled the constant-current dynamo.

A direct-current dynamo may have either a shunt, a series or a compound winding on its field. Shunt-wound machines and those having both shunt and series field windings—the latter type constituting what are styled compound-wound generators—are used on circuits where an approximately constant voltage is desired; while the series dynamo is employed almost exclusively on constant-current circuits.

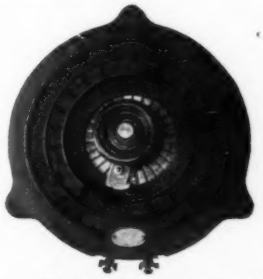


Fig. 4.—Field Rheostat—Front-of-Board Type.

Single-phase alternators are used only where current is wanted for incandescent lamps, arc lamps, heating devices and small motors. If large alternating-current motors are to be operated on the circuit, either two-phase or three-phase power is required, and hence what are known as polyphase alternators—which may be designed to furnish either two-phase or three-phase current—are employed. In appearance and cost the polyphase generator is about the same as a single-phase machine. Moreover, the former type of alternator is adapted to any service which a single-phase alternator can supply. The use of the single-phase machine is, in fact, rather rare now.

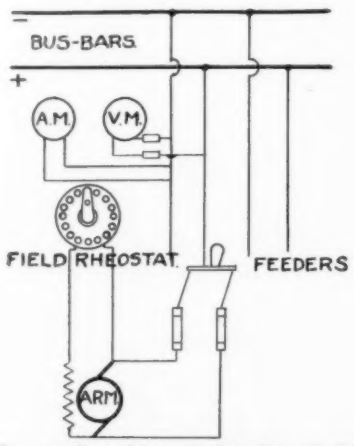


Fig. 6.—Switchboard Circuits of Direct-Current Generator.

Most commercial alternators are of the revolving-field type. As already mentioned, in a generator of this class the armature remains stationary and the field revolves. The main advantages here are the ease with which the armature conductors may be insulated for high voltages, and the fact that the electric current is led from the machine over fixed terminals instead of through sliding contacts.

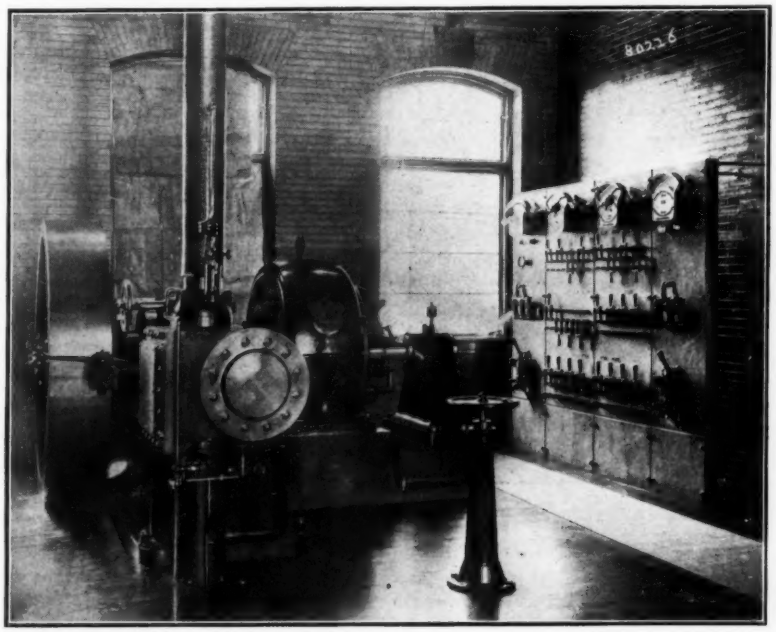


Fig. 5.—Showing Clearance Between Switchboard and Wall—Generator Leads Under Floor.

The current generated by the dynamo is led to the switchboard busbars and then, by means of conductors and switches, to wherever required. On the switchboard, besides the switches, voltmeters and ammeters are mounted for indicating the voltage of the current generated, and also the amount of amperes. The field-rheostat handle also projects through the front of the panel. This rheostat is used to regulate the magnetization of the generator field poles and therefore to control the voltage. Where several dynamos are installed in one room the switchboard panels for each machine are usually mounted side by side. For small installations front-of-board type field-regulating rheostats are mounted on the front of the panel or below it. These are less expensive than the rear-of-board type, which is obvious from the illustrations in Figs. 2, 3 and 4.

The wires connecting the generator with the switchboard are run overhead or in conduit, or else lead-covered cables are laid in a tile or cement duct in the floor. This work should be thoroughly done, so as to insure the prevention of short-circuits between the conductors.

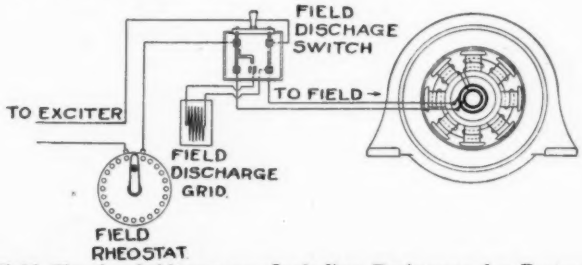


Fig. 7.—Field Circuit of Alternator—Including Resistance for Protecting Field When Circuit is Opened.

Switchboards should be placed several feet from the wall, as shown in Fig. 5.

Fig. 6 shows the connection of the field-regulating rheostat and Fig. 7 shows this connection for an alternating-current generator. By adjusting the current supplied to the field magnets or poles, the voltage generated by the alternator or the direct-current generator can be varied. Putting in

field-regulator resistance decreases the current to the field magnets and thus reduces the voltage of the current generated.

Installation of Generators.

Wherever possible, dynamos should be located in dry, light, well ventilated rooms. If moisture is allowed to settle on windings or on commutators, current leakage, charred insulation, commutator and brush troubles, and other disturbances are quite liable to occur. Where electric motors are employed in industrial plants for driving pumps and similar apparatus, it is necessary to make sure that in case of fire there will be no interruption in the current supplied to the motors. Hence, if the source of power is a generator in the industrial plant itself, this generator should be located in a fireproof room separated by firewalls and firedoors from the main plant.

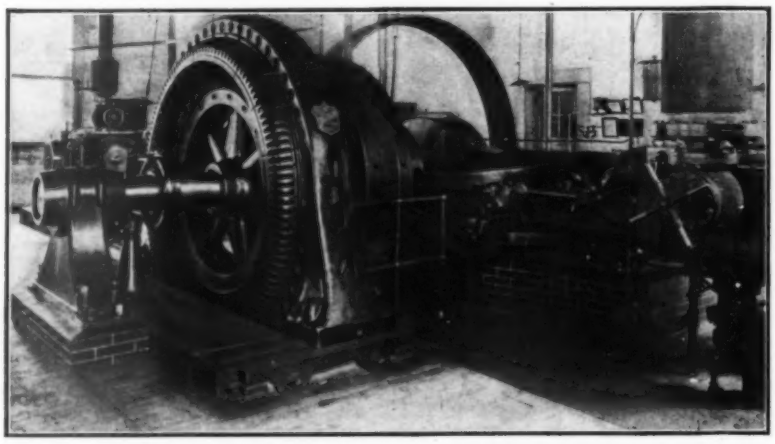


Fig. 8.—Engine-Type Alternator Unit and Foundation.

Concrete or brick foundations are recommended for electric generators whose capacity is 50 kilowatts or more. (See Fig. 8.) This provision is necessary to insure freedom from vibration. Concrete of two parts sharp sand, four to five parts broken stone, and one part Portland cement is widely used for foundation work.

After the machine is in place it should be carefully aligned and firmly bolted to the foundation. The armature should be easily turned. If belt connected, the belt should run to the center of the pulley.

Before starting, the bearing oil wells should be filled with good mineral dynamo oil and the oil-well cover put in place to prevent dirt and dust from getting into the bearings. The oil rings should revolve easily and carry oil. The brushes should fit the commutator and be clean. By holding the smooth side of a piece of coarse sand paper against the commutator and rubbing it back and forth between the brush and the commutator the bearing surface of the brush can be ground to an even, close-fitting seat. Fine sand paper may be used to finish the smoothing. Emery cloth should never be used for this purpose.

Commutators and slip rings can be kept in good condition by using a small piece of canvas cloth and applying vaseline at intervals.

For noting whether the armature revolves easily the generator may be run for a short period with the connection to the field-regulating rheostat opened temporarily.

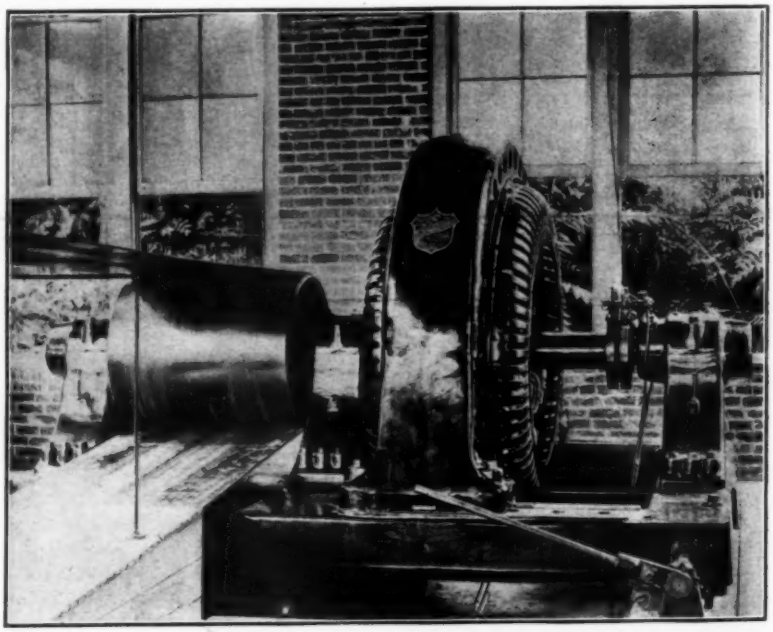


Fig. 9.—View of Alternator Showing Slip Rings on Shaft for Carrying Current to Field Poles.

When it is known that bearings, oil rings, and armature are all right, the field rheostat may be connected up and the handle revolved so as to have all the resistance in the circuit. This is the same as turning it in the direction marked on dial by arrow "To lower voltage."

Now the generator may be brought up to its normal speed and the field-regulator handle turned in the opposite direction. This cuts out resistance, increases the magnetization of the field poles and increases the voltage generated. The handle should be turned slowly until the voltmeter indicates the normal, rated voltage of the generator. The main switch connecting the generator to the busbars from which current is drawn can then be closed. With a shunt dynamo, when current is supplied to lamps or motors the voltage will drop somewhat and the regulator handle will have to be moved to cut out more resistance. If the generator is compound-wound and when supplying current to a load the voltage drops considerably, it may be because the series-field circuit is connected so as to oppose or neutralize the effect of the shunt-field circuit. Reversing the series leads will correct this.

The field-rheostat handle should be in such location that in operating it the voltmeter can be watched. Before closing down, the handle should be turned in the direction "To Lower Voltage."

Small dynamos are often placed directly on the wooden floor, but it is better to place them on two parallel timbers, which act as rails. Jack-screws provide a means for tightening the belt. Where the machines operate at a voltage not over 550 they should be insulated from the ground, and the floor and the timbers mentioned above should be filled with oil or shellac to

prevent absorption of moisture. In securing the timbers and dynamo the bolts used should not form a path from the dynamo frame to some other current-carrying pipe or beam.

known path for any possible leakage of current. Breaking down or charring of the insulation in the field or armature coils or brush leads may result in trouble at unlooked-for locations, unless the machine is permanently insulated or else properly grounded. No. 4 or No. 6 B. & S. gauge stranded rubber-covered wire connecting the dynamo base to the water pipe near its entrance to the building provides a suitable ground. The wire should be secured by a ground clamp and soldered in place. The ground wire should always be run in accordance with rules for wiring described already.

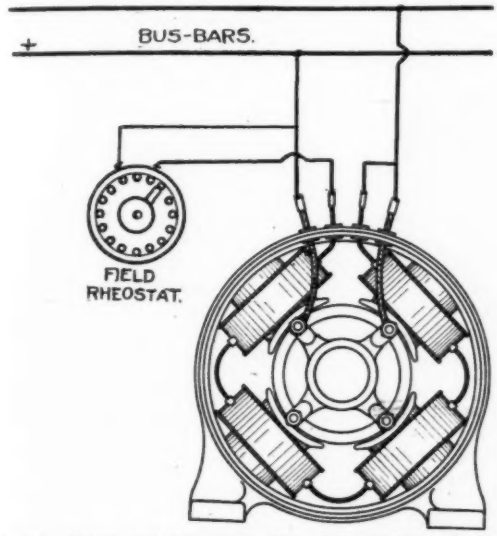


Fig. 10.—Field and Armature Circuits of Direct-Current Generator.

Where it is impracticable to insulate the dynamo thoroughly from the ground, and where the operating voltage is greater than 550 volts, the base frame must be grounded. Dynamos

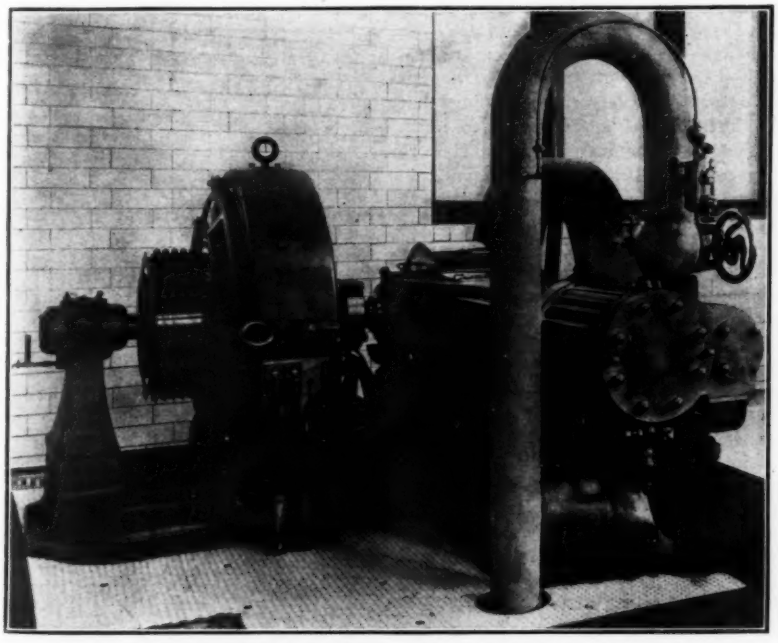


Fig. 11.—Engine-Driven Exciter—Wiring in Conduit Under Floor.

connected directly to engines are difficult to insulate and therefore are grounded. The reason for grounding is about the same as for grounding iron conduit, as explained previously. It is desirable to provide a definite

Constant-potential direct-current dynamos must have fuse or circuit-breaker protection against excessive current. In the case of two-wire generators this protection must be placed in the lead which receives the entire current. This would mean that for such an installation as that shown in Fig. 9 the protective device should be placed usually in the positive lead, although fuses and circuit-breakers are often placed in both leads in practice. When supplying three-wire systems, the dynamos

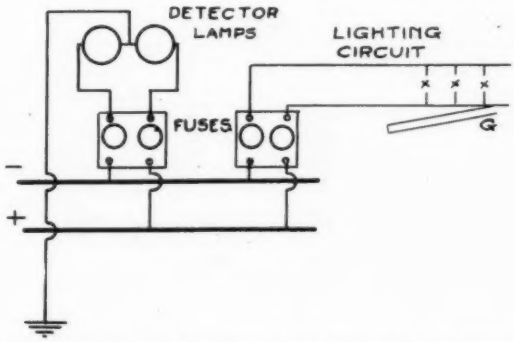


Fig. 12.—Ground Detector for Two-Wire System.

should have fuses or circuit-breakers in the outside wires.

As there is chance of any wire or instrument on the switchboard carrying current in excess of its safe capacity, due to accidents or breakdowns, the voltmeter, ground detector, pilot lights and potential transformers must also be protected by fuses of the proper capacity. Circuits of this kind on the switchboard must not be wired with wire smaller than No. 14 B. & S. gauge, and must not carry more than 660 watts. The separate fuses for pilot lights and voltmeter should not be larger than two amperes' capacity. Inclosed fuses are to be preferred, but if the switchboard is set on a non-combustible floor and is not near anything combustible open link fuses may be used. Fig. 9 and Fig. 10 show diagrams of connections for alternating-current and direct-current generators.

An alternating-current generator requires direct-current for its field poles and the small direct-current dynamo is run sometimes on the same shaft or is belted to the same engine. This dynamo, an engine-driven type of which is shown in Fig. 11, supplies the field-exciting current. The exciter has its field rheostat, the same as the direct-current generators described above, and there is also a field rheostat in the circuit from this exciter to the field poles of the alternator. In alternators of the revolving-field type the exciting current is passed to the field poles by means of brushes in contact with slip rings.

In starting an alternator both field rheostats, that in the exciter circuit and the one in the alternator circuit should have all resistance in. The exciter field-rheostat handle should then be operated to cut out the resistance until the voltage indicated on the excited voltmeter reaches the normal rated value. Next close the alternator-field circuit and after running a short while with the exciting voltage low, cut out the resistance, by turning the field-rheostat handle gradually in the direction "To Raise Voltage." Watch the voltmeter in the alternator circuit and turn the handle until the voltage indicated is of the rated value. After the alternator begins to supply current for lights and motors it will be necessary, in order to maintain the normal voltage, to operate the field rheostat, cutting out more resistance.

Before closing down an alternator all the resistance in the field rheostat should be cut in, to lower the voltage;

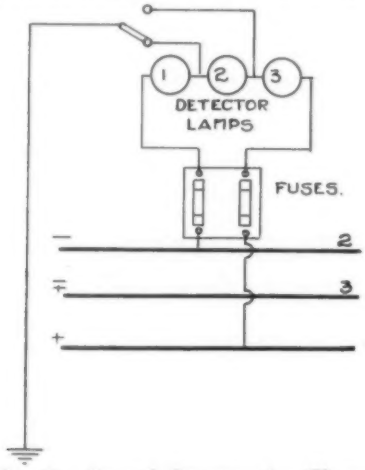


Fig. 13.—Ground Detector for Three-Wire-System.

then the main switch is opened, and, lastly, the field switch. A high induced voltage, or electromotive force, often sufficient to rupture the insulation of the field-pole winding, is caused by opening the field switch while the full current is still flowing; therefore the above precautions.

Where insulated wire is used on switchboards to connect rheostat resistance with the contact plate, the insulation must be of the "slow-burning" kind. For large field rheostats (sometimes motor-driven and remote-controlled), the wires connecting the contact plate on the switchboard with the resistance units or grids may be run together in groups if the voltage between any two wires in a group does not exceed 75. Asbestos-covered wire is used where there are many wires.

Lightning Arresters.

A generating plant which supplies current for a manufacturing concern or for a small group of buildings, or one which feeds only a short outdoor line, seldom requires a lightning arrester attached to each of the overhead wires.

Where lightning disturbances are frequent, however, arresters may be desirable. Lighting and power companies, since they supply outdoor, overhead circuits of considerable lengths, need arresters at the station and at other points of the system as well.

Arresters should always be placed away from combustible material, at the point where the wires leave the building, and be connected by No. 4 or No. 6 B. & S. gauge wire or their equivalent. As this wire may carry in time of lightning discharge, a current of very high frequency, it should run in a straight line to a good ground connection—not to a gas pipe in the building. It should not be run in conduit, because of the inductive effect, which might so resist the flow of lightning current to the earth as to make it leave the wire at some other point than the ground and do damage. Where a choke coil is used in connection with the lightning arrester to protect the generator or other electrical machinery from lightning discharge, it should be insulated from the ground and from other conductors.

Ground Detectors.

For proper operation of electric lamps, motors, etc., it is necessary to have the circuits to them free from grounds. Also, because of the fire hazard, the circuit wires should be always free from contact with anything that might in time conduct current to earth. When properly installed according to the rules for the various systems previously explained, the wires will not be in contact with steel or iron I-beams, metal pipes, masonry walls or floors. After installation, however, the wires sometimes become misplaced through accident, by expansion, jarring of building, or by loosening of insulators and fittings in some other way. Current leakage, through some pipe, for instance, to earth will pass back to the other side of the line when that side comes in even slight contact with another pipe, beam or other conductor. At the points where the current passes to or from the ground heat will be generated and arcs occur. As these points usually happen out of sight, a fire is very apt to result, or, at any rate, damage to the conductors and the dynamo. Grounds on combination gas and electrical fixtures are of not uncommon occurrence.

While a ground on one side of a two-wire system does very little harm, yet it is for the purpose of learning when this occurs that ground detectors are used. Where several circuits are fed from a pair of busbars and a ground is indicated by the detector lamps, it may be found by means of elimination. If there are, say, five circuits, all circuit switches but one can be opened. Next circuit No. 2 can be closed and the four others opened; next No. 3, and so on. It may also be possible that a ground on more than one circuit may occur at the same time.

Fig. 12 shows the ground-detector lamps and their connection to the busbars and the ground. When the system is insulated and free from grounds both lamps will burn with equal brilliancy. If these are lamps of the same voltage as the system, they will burn with a red glow as being in series; ordinarily they will each be operated at one-half their rated voltage. Under insulated conditions the lamps are oper-

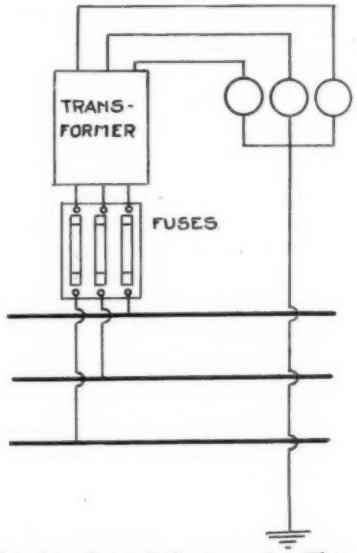


Fig. 14.—Ground Detector for Three-Phase System.

ating as two lamps in series. But if the positive wire of one of the circuits in passing over a gas pipe becomes loosened from its supporting knob and because of fumes of certain kind has its insulation spoiled and finally permits leakage of current to the gas-pipe system, the one lamp will get practically full voltage and will burn brightly while the other will burn a dull red or possibly not glow at all. In the figure referred to, the current can be traced. From the positive busbar it passes to the circuit; some escapes to the grounded gas-pipe system, comes back up through the ground wire, passes through the left-hand lamp and then to the negative busbar. Therefore when the lamp which connects to the negative busbar is brighter, the ground is on the positive side of the circuit, and, when the lamp connected to the positive busbar is the brighter, the ground is on the negative side.

With some detectors a push-button switch is installed ahead of the lamps, so that only when this is pushed will the lamps indicate. Lamps which are constantly in circuit are better, as the indication of a ground is then given as soon as it occurs, and it is immediately detected.

The lamps used should preferably be of the same candlepower and voltage as those used generally in the plant, 8-candlepower or 16-candlepower carbon-filament lamps being used most. The receptacles for the lamps should be keyless, and be close together so that difference in the brightness of the lamp can be easily detected. As in all other cases of grounding, the connection to the water pipe or other grounded metal should be thoroughly well made.

On high-potential systems—500 volts and over—such as are found on series arc-lamp circuits, incandescent lamps are not suitable as ground detectors. In place of lamps, an indicating voltmeter is connected in circuit in the same manner. The pointer of this meter indicates the side on which the ground has occurred and also indicates whether the ground is a slight one or a bad one. A bad ground means one permitting a large flow of current to earth, as in case of a complete breakdown in the insulation.

With a three-wire direct-current system it is necessary to introduce a two-position switch, or else grounds on the neutral and either outside wire would be indicated in the same way. This switch may be a push-button type having no "off" position. With the switch in the position as shown in Fig. 13 a ground in the positive or neutral wire would both cause lamp No. 1 to burn brightly and No. 2 and No. 3 dimly. A ground on the negative side of the circuit would be indicated in this position of the switch by brightening of lamps No. 2 and No. 3 and a dimming of No. 1. To ascertain which line, the neutral or positive, was grounded, the switch would have to be closed in the other position, then a ground on the positive would cause No. 1 and No. 2 to brighten, while a ground on the neutral would be indicated by the dimming of these two and the brightening of lamp No. 3.

For alternating-current single-phase circuits the two lamp detectors used for the two-wire direct-current system can be used. For polyphase systems where the voltage is high, lamps cannot be put across the phases. Indicating meters may be used or transformers put between the main busbars and the lamps, as shown in Fig. 14. Where the voltage is low the transformers may be omitted.

W. J. Squire.

The gentleman concerning whom the following is written is known to his friends as Jack Squire—which means that Mr. Squire is known as "Jack" over large portions of many of the states of the Southwest, where, as the manager of the Squire Electric and Construction Company, of Kansas City, Mo., he has been engaged in electrical work at one time or another. Mr. Squire was born in Kalamazoo County, Mich., in 1874, but spent most of his boyhood in Kansas, from the university of which state he graduated in 1896, with the degree of Bachelor of Science in Electrical Engineering. After graduation, he was in the electrical construction business for a time in St. Louis, and was later an electrical engineer for the United States Government. In 1899 he went to Kansas City, Mo., as a superintendent for one of the

W. J. Squire.

companies engaged in electrical construction there. Six years thereafter he organized the Squire Electric Company, which was afterward incorporated as the Squire Electric and Construction Company. The headquarters of this concern are at 614-618 Wyandotte Street, in the ctiy last named, and Mr. Squire is the vice-president and general manager.

Mr. Squire's company has done the electrical work in many of Kansas City's largest and most modern buildings; notable among these being the R. A. Long Building, the Waldheim Building, the Rialto Building and the Plant of the National Biscuit Company. Still another notable installation was that provided for lighting the Inter-City Viaduct, two miles in length. The company has also installed a large number of complete central stations in various parts of the Southwest, seven plants of the kind having been completed within the past year.

Mr. Squire is a member of the National Electrical Contractors' Association; a Statesman for the Sons of Jove, in Missouri; an associate in the American Institute of Electrical Engineers; past president of the Electrical Contractors' Association of Missouri, and of the Electrical Contractors' Association of Kansas City; and a member of the Master Builders' Exchange of Kansas City, and of the Engineers' Club. He is also a member of the Knife and Fork Club, and of the Kansas City Electric Club.

Grounding the Case of High-Tension Apparatus.

During the month of January while working in the basement of a new church in Toronto, Can., a sheet-metal worker stumbled across an ordinary Canadian General Electric Company's oil-immersed auto-starter connected to a 550-volt three-phase motor, with the result that he was instantly killed. Subsequently a test was made by the Fire Underwriters' inspector which disclosed that the iron handle and case of the auto-starter had in some way become alive, showing a difference in potential of 500 volts between it and the ground. The current furnished was three-phase 25-cycle. The installation had been put in without any notice to the Electrical Department for inspection, as the building was not yet occupied.

The question of grounding these cases is now before the Underwriters and other parties interested in Toronto, and it is altogether likely that steps will be taken to ground all such apparatus on alternating circuits from 125 volts up and on direct-current circuits from 250 volts up. So far as the Underwriters are concerned, they favor the grounding of such apparatus at the voltages mentioned.

The fatality referred to shows that the present Code rule on grounding is not adequate.

Electric Enterprise in Northern Mexico.

An electric enterprise, known as the "Compania Hidro-Electrica Mexicana," has been organized in Canada with a capital of $15,000,000, to operate in the States of San Luis Potosi, Nuevo Leon and Tamaulipas, using for the generation of electric power the waters from the Naranjos River in San Luis Potosi, and the Blanco River in Nuevo Leon and Tamaulipas, and other waters which may be available under their concession.

It is calculated that the different installations will be ready for use by November 1, 1913. There will be three generating stations on the Naranjos River, near Micos on the Aguascalientes to Tampico branch of the Mexican Central Railway, another generating station between Minita and Paso del Macho, and two more stations at Elbanos. One hundred thousand horsepower is to be obtained at present, and the transmission lines will extend over a distance of 828 kilometers.

Thawing Frozen Water Pipes.

The Consolidated Gas, Electric Light & Water Company of Baltimore, Md., utilizes a portable truck and transformer for thawing frozen water pipes. A connection is made to any live circuit available and the secondary of the transformer is joined to each end of the frozen section of pipe.

Considerable trouble has been experienced this winter, especially in the suburbs of the city, and Herbert A. Wagner, vice-president of the company, found this the most satisfactory arrangement for the purpose. A short time ago a four-inch main was thawed out in a few minutes by means of this apparatus.

Cost of Underground Construction at Haverhill, Mass.

In connection with the installation of an underground distribution system, the Haverhill Electric Company has prepared the following figures of actual costs of work in the field. One and thirty-eight hundredths miles of street have been excavated and back-filled in connection with the installation, which occupies the business center of the city. The total cost of the work, including all incidentals, was $100,819.34. The installation was designed and placed in service under the supervision of the engineering department of the Tenney Companies, a Boston house operating central-station and gas systems at Malden, Fitchburg, Springfield and other cities in the East. D. A. Harrington, of Boston, acted as consulting engineer.

TABLE I. CONDUIT INSTALLED.

Number of Ducts	Length in Feet	Duct-Feet
1	7,015.3	7,015.3
2	2,837.3	5,674.6
3	997.1	2,991.3
4	304.1	1,216.4
6	697.7	4,186.2
8	354.6	2,836.8
14	1,226.0	17,164.0
22	1,808.6	39,789.2
26	1,382.6	35,947.6
30	73.9	2,217.0
Total	16,697.2	119,038.4

The average total cost per duct-foot was 84.5 cents, and the average cost per foot of conduit installed, including all costs, was $6.03. The average number of ducts laid in the installation was 7.1. In Table II are given the various lengths of cable drawn in.

TABLE II. CABLE INSTALLED.

Size No.	Length in Feet
14	2,400
6	30,204
4	8,700
2	10,192
0	85,002
00	16,893
0,000	1,748
300,000 c. m.	6,644
400,000 c. m.	1,086
Total	162,869

Length in feet occupied by underground conduits in streets or ways, 7,260. Number of manholes, 76. Number of service connections, 225.

TABLE III. COSTS OF UNDERGROUND CONSTRUCTION.

Legal expenses	$ 25.00
Labor and material used in making plans	1,329.82
Services of engineers	3,043.39
Traveling expenses of engineers	147.81
Services and traveling expenses of superintendent and inspectors	1,229.96
Office expenses	356.60
Insurance	102.38
Property damage	30.03
Sundry items	3,609.67
Miscellaneous material	1,294.88
	$11,169.54

CONDUIT.

Duct and all material, including transportation	$10,328.85
All labor in installing duct, including excavation, etc.	5,836.02
	$16,164.87

MANHOLES.

Cost of covers and all material, including transportation	$ 7,642.28
All labor in connection with manholes	4,155.78
	$11,798.06

UNDERGROUND SERVICE AND DISTRIBUTION POLE CONNECTIONS.

Duct and all other material including transportation	$ 6,752.26
All labor in connection with installation	5,151.34
	$11,903.60

HIGH-TENSION CABLE.

Cost of cable and all material used	$21,638.33
All labor of installation	2,945.49
	$24,583.82

LOW-TENSION CABLE.

Cost of cable and all material used	$ 6,339.47
All labor of installation	2,883.87
	$ 9,223.34

CUSTOMERS' WIRING.

(Changes made necessary by installation of the underground system.)

All material used in connection to underground inside of building	$6,854.20
Labor in connection with changes	2,934.62
	$9,788.82

CUSTOMERS' MOTORS.

(Changes made necessary by installation of the underground system.)

Material used in making changes	$2,109.78
Labor in above	376.53
	$2,486.31

STREET OBSTRUCTIONS.

Removing obstructions, material	$ 827.74
Removing obstructions, labor	2,873.24
Grand Total	$100,819.34

Thawing Water Pipes.

Our company owns the city water system as well as the lighting and power system of the city. During a cold spell this winter some of our branch pipes from the street to the buildings were frozen. As it would have been expensive to dig up the frozen ground we decided to try thawing them by electricity. The only transformer available was rated at 7.5 kilowatts, 2200 to 110-220. We connected the primary of this to a 220-volt secondary, and the secondaries we short-circuited on the water pipe. that is, we connected one side to the faucet in the house and the other side to the pipe where it connected with the main pipe. It worked very satisfactorily. T. H. Foley.

LETTERS TO THE EDITOR.

Edison Plug Fuses With Ungrounded Neutral.

To the Editor:

In his article, "Notes on Electrical Construction," appearing in your issue of February 10, Mr. Kirchgasser's statement to the effect that Edison plug fuses may be used in each wire of a 110-220-volt, three-wire system having an *ungrounded* neutral, is not in accordance with the National Electrical Code, which limits the use of such fuses to 125 volts except on three-wire systems having grounded neutrals, where the difference of potential between the outside wires does not exceed 250 volts.

The object of this limitation, as I understand it, is to prevent the use of these fuses on systems where it is possible to impress upon them a higher voltage than that for which they are intended. This condition may occur on a 110-220-volt, three-wire system, through the *accidental grounding* of one of the outside mains, in which event the grounding of a tap wire on the opposite side of the system will result in a short-circuit to the ground of 220 volts with only one fuse in the circuit blowing. It is needless to say that Edison plug fuses are not designed to withstand such severe service, and, when so used, not infrequently result in the destruction of the fuse block itself. Such accidents can only be prevented by *permanently grounding* the neutral wire as required by the Code.

FERGUS P. MCGOUGH.

Omaha, Neb., February 13, 1912.

Drafting-Room Lamps.

To the Editor:

We were interested in a description of drafting-room lamps described and illustrated on page 275 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, in the issue of February 10, as it is identical in every detail with one we installed several months ago. There is one point, however, which the casual observer would not notice, and that is, inside of each knob is a piece of rubber similar to a lead-pencil eraser, which fits the wire snugly and prevents the knob from sliding, once placed where required. We found this was necessary, as when the knobs wree installed without the rubber they gradually shifted back to a place beneath the outlet.

DAVIS ELECTRIC COMPANY.

Newark, N. J., February 15, 1912.

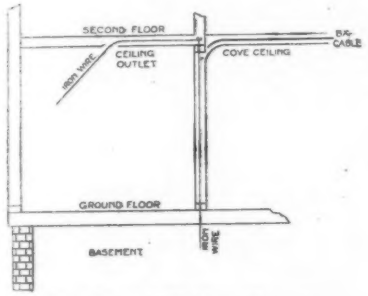
Fires have been caused by striking an incandescent electric light while carrying something through a room, the broken filament falling on combustible material. This can be avoided by putting wire guards on all exposed lamps.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Fishing Wires in Walls and Between Floors.

In wiring old houses in which upper rooms have polished or double floors and where it is necessary to install ceiling outlets in rooms below I find it very convenient to go about the job in the following way. If there are cove ceilings and BX cable is used, the matter is a very easy one. Simply start the BX at the outlet in the ceiling and push it toward a partition in the center of the house and it will readily go down the partition, between the walls, to the basement. Here a hole can be bored through the plate and the cable fished out. If there is no cove ceiling, however, I take a No. 20 bit and bore through the plate in the basement; then I add several extensions until the plate holding the ceiling joists can be bored through. I next take a piece of No. 8 iron wire and push it from the ceiling outlet over the partition; after which I can go to the basement and push another piece of wire up the partition, through the holes just bored, so as to catch the first wire and pull it down. With the assistance of a helper it is then very easy to attach two copper wires properly incased in flexible tubing to the end of the iron wire protruding from the ceiling outlet and pull these wires into the proper position for the circuit. I like this plan especially because it does not necessitate the tearing up of floors.

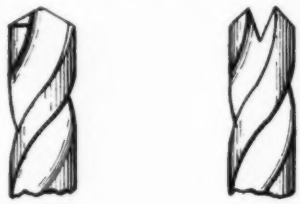


Details of Fishing Process.

John Gunning.

A Rapid Drill for Marble or Slate.

I have had occasion many times to drill holes in marble or slate switchboard panels, and, like other people who have done work of this kind, have always found the job a slow one. A previous Wiring Kink recommended the use of a small drill to begin with, and that this be followed with a drill which would leave the hole the desired size. This method is all right, but I find it a good plan to proceed as follows in drilling the first or smaller hole. Two quarter-inch drills, which in the figure are marked A and B, are procured and one of them is ground or filed as shown in B. The center is then marked with a punch care being taken not to crack the panel in the meantime, and the hole is started with drill A. As soon as the hole is deep enough to hide the paint of drill A, drill B is substituted and the hole bored through with it. The job is then finished with a larger drill. This is easily the best way I know of for boring switchboard panels.



Drills for Switchboard Work.

A. D. Kerr.

Segregating Street-Lighting Circuits.

In small towns which use series incandescent lamps for lighting the streets, the entire street-lighting system is frequently carried on one circuit. Thus if a lamp happens to blow down or a bad ground develops at any point, all the streets are put in darkness until the trouble can be repaired. To attempt to avoid this by splitting up the system into several circuits and supplying a regulator for each circuit would usually carry the cost to prohibitive proportions. The accompanying sketch indicates a plan which I have adopted for service of this kind which works well. I arranged the street circuit in three loops, across each of which a switch is installed, on the switchboard. Ordinarily the switches are all kept open, thus putting the loops in series. However, when trouble develops first one and then another of the loops is cut out until the loop on which the disorder has developed is found. Then this switch is kept closed until repairs can be made.

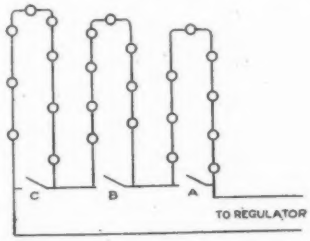
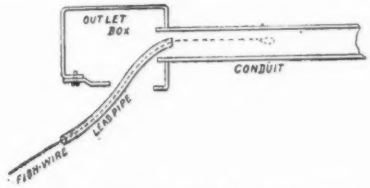


Diagram of Division of Circuit.

W. H. Few.

Fishing Wires in Conduit.

When fishing wires on a conduit job, I find that a short length of lead pipe such as is used in connecting bar fixtures is very handy. By inserting the end of this in the conduit pipe, as shown in the figure, a guide is provided for the fish-wire which keeps it from kinking down in the outlet box and thus lengthens its life and also prevents a great deal of annoyance to the workman. Moreover, a device of this kind may be made very useful in fishing side-wall outlets, since with a piece of the pipe two feet long the use of a step-ladder may be avoided. My attention was first called to the convenience of the device in question while I was using a piece of cast off lead sheath from a telephone cable to blow soapstone through conduit.



Sketch Showing Lead Pipe in Use.

Charles E. Abrams.

Thawing Out Water Pipes.

Often we are called upon to thaw out water pipes on the outskirts of the city, where transformers are too small.

I load an ordinary 20-kilowatt transformer on my rig and use it to thaw out pipes. I first make the secondary circuit with No. 6 weatherproof wire, which is run along the ground to the service pipe in the house, and to a hydrant or sill cock of the neighboring house. Then I run No. 12 weatherproof wires along the ground to tap the primaries. In five or ten minutes the water begins to flow.

H. J. Bluhm.

In New York City nearly 50,000 new consumers of electric current are connected per annum; in Chicago 25,000; in Philadelphia, 15,000.

In the rapidly growing city of Vancouver, B. C., with a population of about 125,000, there were over 10,000 new connections in one year.

Among the Supply Men

Elctrical Supply Jobbers' Convention.

The Electrical Supply Jobbers' Association held its spring convention at Cleveland, O., February 13, 14 and 15. Headquarters were established at the Hollenden Hotel, and meetings were held on the morning and afternoon of each day of the session. On Monday morning the Atlantic Division held its executive meeting, and on Monday afternoon the Central Division held its executive meeting. All of the subsequent meetings were general in character, embracing all divisions. The meetings were devoted to discussions of subjects of an educational nature related to the jobbers' interests, and addresses were made by W. H. Merrill and Hugh T. Wreaks of the Underwriters' Laboratories respecting the relation of the supply men to the work of the Underwriters. On Thursday morning an important session was devoted to a meeting of jobbers and representatives of the lamp manufacturers, addresses being made by A. D. Page and F. S. Terry, outlining plans for closer co-operation between the supply man and the manufacturers. It was decided to hold the next meeting at Atlantic City, N. J., about the middle of May.

On Wednesday afternoon a trip of inspection was made of the works of the National Carbon Company, and on Thursday afternoon the works and engineering department of the National Electric Lamp Association were visited.

On Wednesday evening there was a torch-light parade and rejuvenation of the Sons of Jove, a class of 62 being initiated into the order. The initiation was followed by a Dutch supper.

The Jobbers and their guests and the visitors attending the convention were royally entertained by the electrical people of Cleveland. Under the auspices of the Electrical League of Cleveland a series of entertainments was tendered the visitors which will make this convention one long to be remembered. The chief feature of the entertainment was a valentine smoker and party given by the Electrical League of Cleveland at Gray's Armory on Wednesday evening, February 14.

The following commitees were in charge of arrangements:

Entertainment—H. H. Cudmore, chairman; T. P. Cagwin, R. G. Pate, H. C. Rice, David Aitken, W. C. Wing, J. G. Pomeroy.

Finance—J. Robert Crouse, chairman; D. D. Dickey, S. H. Worbs, Samuel Scovill, R. F. LaGanke, P. Yensen, Fred C. Werk.

Hotel—C. T. McKinstry, chairman; Louis Griesser, Harry Hutchinson.

Sight-Seeing—N. C. Cotabish, chairman; Glenn C. Webster, J. G. Pomeroy.

Press—Pierre L. Miles, chairman; Napoleon P. Boynton.

Reception—A. L. Oppenheimer, chairman; George S. Milner, Harry Allen, S. R. Sague, J. F. Kerlin, H. F. Martien, Walter P. Ambos, A. B. Haviland. C. L. Eshleman, chairman Ladies Reception Committee; L. J. Sinnott, E. M. Smith, W. Proctor, Ed. Buel.

The Jobbers were welcomed to Cleveland by a brief address by David Aitken, president of the Electrical League of Cleveland, and a response for the Jobbers was made by Judge Debevoise. Promptly at 8:30 p. m. the curtain rose upon a grand Colonial minstrel show. Without doubt this was the most enjoyable entertainment ever accorded an electrical gathering. Under the direction of Herbert H. Cudmore the minstrels rendered an exceptionally fine program. Special mention should be made of the excellent singing by D. E. Vaughn, Clark Baker, R. B. Hunter, C. C. King, George Zerbes, William Michael, W. E. Conley and I. Owens. Mr. Cudmore rendered a solo entitled "My Little Havana Made," which brought down the house, and then the minstrels joined in singing the traveling salesmen's songs and a rousing closing chorus embellished with the Star Spangled Banner in electric lamps.

The second part of the vaudeville entertainment included vocal and instrumental selections by Milt Wood; W. H. Webster and W. M. Skiff, who performed a remarkable skeleton dance; D. M. Gardner and Roy Sample; and Messrs. Shenton, Rittenhouse, Terry, Vaughn, Zerbes, Hunter and Stover.

A delightful feature of the entertainment was the dancing of Miss Vida Nelson Cotabish in dance pictures and dance poems arranged by Eleanor T. Flynn.

After the entertainment there was impromptu singing from the League song books under the directorship of Robert Pate, and supper was served at the tables. The favors included cigars, Jovian cigarettes, a carnation and an automatic cigar lighter, the latter being distributed through the courtesy of the American Eveready Company.

There was a large attendance of both jobbers and manufacturers' representatives. Among those present were the following:

Jobbers in Attendance.

Franklin Overbagh, general secretary, Electrical Supply Jobbers' Association; E. Jumonville, Electrical Supply Company; H. C. Chappel, Manhattan Electrical Supply Company; W. D. Taylor, H. H. Rudd, the Geo. Worthington Company; George Patterson, Frank W. Eastman, Stanley & Patterson; J. R. McNaughton, McNaughton-McKay Electrical Company; J. P. Provost, G. W. Provost, Union Electric Company; Frank C. Teal, Frank C. Teal Company; S. W. Glover, The Post-Glover Electric Company; Wm. G. Campbell, Campbell-Stagg Company; William J. Burns, H. T. Sands Electric & Manufacturing Company; R. P. Ablinger, Indianapolis Electric Supply Company; C. Phillips Hill, Doubleday-Hill Electric Company; C. B. Walker, Varney Electrical Supply Company; F. N. Averhill, Fobes Supply Company; H. S. Wilson, F. H. Stewart Electric Company; Henry L. Walker, Henry L. Walker Company; A. M. Little, Mohawk Electric Supply Company; John J. Cooper, Mountain Electric Company; C. H. Kelley, Rumsey Electric Company; A. G. Munro, Nebraska Electric Company; Frank W. Pierce, Manhattan Electrical Supply Company; L. W. Kittman, Overbagh & Ayres; Walter S. Clark, James Clark, Jr., James Clark, Jr. Electric Company; William T. McCullough, Wm. T. McCullough Electric Company; F. M. Bernardin, B-R Electric & Telephone Manufacturing Company; H. C. Lucas, the Philadelphia Electric Company; G. W. Johnston, Johnston Electric Company; Harry C. Dyer, Southern Electrical Company; C. B. Hawley, Inter-Mountain Electric Company; Charles E. Brown, Thomas Ringgold, Central Electric Company; F. A. Brooke, Illinois Electric Company; William H. Seldon, Jr., Miller-Seldon Electric Company; William J. Harting, Wm. J. Harting Company; W. F. Bissell, F. Bissell Company; C. N. Trump, Novelty Electric Company; H. E. Hobson, Hobson Electric Co.; W. E. Robertson, Robertson-Cataract Co.; B. B. Downs, St. Paul Electric Company; J. B. Terry, J. B. Terry Company; J. A. Vaughan, H. C. Roberts Electric Supply Company; W. W. Low, Electric Appliance Company; M. B. Austin, M. B. Austin & Company; C. C. Sibley, Stanley & Patterson; E. C. Graham, National Electric Supply Company; Frank Price, Pettingell-Andrews Company; H. R. Worthington, Florida Electric Company; W. D. Shaler, Doubleday-Hill Electric Company; Julian Binford, Jr., Tower-Binford Company.

Manufacturers in Attendance.

S. B. Condit, F. D. Masterson, Condit Electrical Manufacturing Company; Samuel A. Chase, Westinghouse Electric & Manufacturing Company; J. H. McGill, McGill Manufacturing Company; V. R. Lansingh, Harry Swindell, Holophane Company; W. W. Clark, Crocker-Wheeler Company; Warner Jones, Nungesser Carbon & Battery Company; W. A. Stacey, Bryant Electric Company; John R. Nagle, Thomas & Betts Company; E. M. Rockefellow, H. C. Owens, George H. Porter, Western Electric Company; John T. Patterson, Enameled Metals Company; George R. Jones,

Public Service Company; C. M. Crofoot, Thomas J. Fleischer, Crouse-Hinds Company; A. E. Williams, W. D. Munsicker, Colonial Electric Company; D. H. Murphy, H. B. Kirkland, Frank R. Bryant, American Conduit Manufacturing Company; B. H. Scranton, Guido Kuhn, American Electrical Heater Company; E. H. Sutton, National Metal Molding Company; F. D. Crouse, Crouse-Hinds Company; C. S. Knight, Jr., American Steel & Wire Company; H. F. MacGuyer, D. & W. Fuse Company; P. F. Lyons, National India Rubber Company; E. K. Patton, Geo. V. W. Ingham, Bryant Electric Company; C. O. Brandel, R. C. Nash, E. E. Nash, Warren Electric & Specialty Company; P. Worth, General Electric Company; D. L. Markle, Mark Manufacturing Company; K. L. Day, Monarch Electric Company; A. D. Page, General Electric Company; William Coale, Sterling Electrical Manufacturing Company; Robert Gorton, New York & Ohio Company; Chas. W. Ridinger, Iron City Electric Company; A. S. Merrill, W. W. Merrill, Chicago Fuse Manufacturing Company; R. Edwards, Jr., T. H. Bibber, Edwards & Company, Inc.; W. N. Matthews, W. N. Matthews & Brother; W. H. Colman, General Electric Company; J. G. Pomeroy, C. L. Eshelman, Adams-Bagnall Electric Company; G. E. Cullmann, Western Electric Company; W. H. Bauer, American Everready Company; Dana Pierce, W. H. Merrill, Underwriters' Laboratories; C. R. Hunt, General Electric Company; W. D. Steele, H. E. Watson, Benjamin Electric Manufacturing Company; A. C. Garrison, Columbia Incandescent Lamp Company; D. C. Gidley, Crouse-Hinds Company; William Hoagland, H. W. Hall, Western Electric Company; McKew Parr, Hart & Hegeman Manufacturing Company; Roy Briggs, the Fostoria Glass Specialty Company; A. C. F. Keleher, Holophane Company; H. E. Marshall, Detroit Insulated Wire Co.; H. H. Cudmore, W. C. Wing, F. D. Sweeten, Brilliant Electric Company; F. W. Pardee, Ericsson Manufacturing Company; Warren Ripple, J. Lang Electric Company; Thomas G. Grier; James F. Burns, V. V. Fittings Company; H. L. Cope, Cope Electric Company; A. P. Eckert, National India Rubber Company, E. H. Haughton, Fred U. Godfrey, Bryan-Marsh Company; A. F. Hills, Crouse-Hinds Company; Charles I. Hills, P. S. Klees, Franklin Electric Manufacturing Company; C. L. Hight, H. D. Sears; R. Edwards, Jr., Edwards & Company; W. M. Deming, General Electric Company; J. B. Estabrook, Colonial Fan & Motor Company; N. L. Norris, Banner Electric Company; T. G. Whaling, Westinghouse Lamp Co.; F. E. Watts, Sunbeam Incandescent Lamp Company; Frank V. Burton, Bryant Electric Company; W. C. Ward, Peerless Electric Company; George Flading, Trumbull Electric Manufacturing Company; J. S. Corby, Monarch Incandescent Lamp Company; S. O. Phillips, A. N. Palmer, Phillips Insulated Wire Company; M. F. Knapp, General Electric Company; C. W. Price, A. A. Gray, H. S. Tuthill, J. B. McCarthy, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN; C. H. Bowen, Collyer Insulated Wire Company; W. J. Tonkin, Ansonia Electrical Company; W. H. Raymond, Clifton Manufacturing Company; S. D. Levings, Westinghouse Electric & Manufacturing Company; C. E. Corrigan, National Metal Molding Company; S. R. Fralick, S. R. Fralick & Company; C. A. S. Howlett, General Electric Company; H. M. Wilson, G. W. Elliott, C. S. Williams, C. Walker, *Electrical World*; F. C. Maxheimer, Tungstolier Company; C. O. Baker, Wheeler Reflector Company; Robert L. Jaynes, Robert L. Jaynes & Company; G. M. Stuart, Stuart-Howland Company; B. M. Downs, Brookfield Glass Company; Ralph Hemingray, Hemingray Glass Company; W. G. Lane, Economy Electric Company; N. W. Wolcott, Packard Electric Company.

Public Service Commissions

MARYLAND.

W. Cabell Bruce, general counsel for the Public Service Commission, and Louis M. Duvall, its secretary, appeared before the Ways and Means Committee of the House of Delegates of the Maryland Legislature last week in response to a summons to explain what the Commission has been doing in the eighteen months of its existence. A legislative investigation was proposed in the House. The two gentlemen showed very conclusively that it has been of immense value to the State and to the people generally on the showing they made it is likely that the investigation will be dropped. The Senate, however, is considering a similar resolution.

The House of Delegates of the Maryland Legislature has asked the Public Service Commission to delegate a member of its legal staff to assist the House Committee on Corporations in considering bills before that committee. A number of bills have already been submitted which directly or indirectly conflict with the powers of the Commission. A decided sentiment has developed in the committee against releasing from it with favorable reports bills which by special acts compel corporations to do certain things which it is now within the power of the Commission to compel them to do. William Cabell Bruce, chief counsel of the Commission and a former president of the State Senate, will probably be assigned by the Commission to assist the legislative committee.

INDIANA.

About 30 officials and representatives of the interurban lines operating in Indiana met the members of the Railroad Commission February 14 in a conference looking toward the installation of automatic block-signal systems on the various lines in compliance with an order issued by the Commission a year ago. After an address emphasizing the necessity for greater safeguards to protect the lives of passengers by W. J. Wood, chairman of the Commission, the special committee, appointed a year ago to examine and decide upon the most practical system, made a report through its chairman, A. W. Brady. Mr. Brady explained that the committee had examined every known signal device at all applicable to interurban roads and let contracts on the lines of the Indiana Union Traction Company and the Terre Haute & Indianapolis Traction Company for the installation of a system manufactured by the General Railway Signal Company at a cost of about $1,000 per mile. This system does away with semaphores, and substitutes as signals colored lights automatically operated, under a guarantee that the signals could be seen 1,500 feet regardless of atmospheric conditions. Charles L. Henry of the Indianapolis & Cincinnati Traction Company supplemented the report by saying that his company was having eighteen miles installed with a block system controlled by a dispatcher, which he believed would be found satisfactory. This work will be completed within the next 30 days and the cost will not exceed $750 a mile. Chairman Wood of the Commission said that the Commission would extend the time to July 1, at which time the systems contracted for would be completed, and that the Commission would then inspect them.

NEW JERSEY.

The Board of Public Utility Commissioners has dismissed the complaints of George R. Abrams and A. W. Bostwick, against the Delaware and Atlantic Telegraph and Telephone Company. These complaints were identical and were to the effect that prior to the term for which the respondent had agreed to supply service, such service was discontinued. It appeared that the Delaware and Atlantic Telegraph and Telephone Company had a contract with an association known as the Vincentown Rural Company. The contract provided that upon the failure of the subscribers to pay any sum due within fifteen days after bill was rendered, service would be discontinued to the Vincentown Rural Company's subscribers, connected with the Delaware and Atlantic Telegraph and Telephone Company's switchboard at Mt. Holly, until full payment was made. The Board found that the members of the Vincentown Rural Company assumed responsibility for payment to the Delaware and Atlantic Telegraph and Telephone Company of the sums due the latter, and that the failure to make payment of arrearages warranted the Delaware and Atlantic Telegraph and Telephone Company in discontinuing service.

Legal Notes

LIABILITY CREATED BY LEAVING EQUIPMENT IN UNSAFE CONDITION AFTER TERMINATION OF SERVICE.

By Maguire and Mooney.

Many times when service is ordered stopped, or the company, for various reasons, refuses further service, it is of importance to know the relationship existing between the former customer and the company. The company looking at the economical side might decide to leave as much of its equipment on the premises as it could, thus saving the expense of removing and re-installing if some person should desire service in the future.

The rule that the company must at all times maintain its equipment in good condition applies to all the equipment that is being used for the conduct of its business. It also applies to all equipment that has been abandoned by the company.

In Caglione vs. Mt. Morris Electric Company, 67 N. Y. Supp., 660, the company was engaged in the business of electric lighting in a portion of New York City. Its wires ordinarily carried from 1,430 to 1,550 volts. The company, up to January, 1898, had maintained an arc lamp at 857 Ninth Avenue. This light was hung from an iron bar which extended out about three feet in front of the store when it was in use. The framework from which the lamp was hung carried the wires that furnished the current. In January, 1898, the company removed the lamp, leaving the iron bar and the wires through which the electricity had been connected to the lamp. The wires were not secured, but were permitted to hang down from the supports to which the lamp had been fixed. After the lamp had been removed, sparks were seen to issue from the wires from time to time, and the awning against which the wires sometimes struck was slightly charred by the current. Paulo Caglione owned a small fruit store at 853 Ninth Avenue. On the evening of September 2, 1898, he saw the awning on fire. He ran out to put out the fire and in doing so he threw up his hand, and was killed by a shock, his hand having touched the iron framework. The court decided in this case that the company was negligent in leaving its wires, charged with a dangerous voltage, after the service had been stopped or ordered stopped.

When service is discontinued by a power company or telephone company, it is desirable to remove all wires not in use from both private premises and public highways. Otherwise the company is liable for any damage that may ensue through the presence of the wires or equipment. This rule applies even when the wires have been abandoned and when the damage is due to lightning.

The well-known case of Jackson vs. Wisconsin Telephone Company, 26 L. R. A., 101, emphasizes this rule. In that case two frame buildings stood about 325 feet distant from each other. One was known as Floral Hall, being a county-fair building, and the other was a barn belonging to Andrew Jackson. Both buildings were of the same height, and upon the top of each was a flagpole between 20 and 30 feet in height. The telephone company had constructed a telephone line along the highway and had placed a telephone in Floral Hall. The wire that connected the telephone with the highway ran from the hall to the flagpole on Jackson's barn and from there it ran to the highway, where it was connected with the main circuit. A ground wire in the interior of Floral Hall ran from the flagstaff a distance of about 376 feet to the ground, where it was attached to an iron water pipe. In the fall of 1888 the telephone was taken out. The ground wire was left intact, and so was the wire from the hall to Jackson's barn. The wire from the highway to Jackson's barn was taken down. On August 20, 1889, almost a year after the telephone was taken out, a severe storm arose, accompanied by lightning. A flash of lightning descended and the barn of Jackson was destroyed. The flagpole on Floral Hall was completely shattered, while the flagpole on Jackson's barn was untouched. Several witnesses said the flash descended on Floral Hall first, and that the barn was not struck by the lightning. Jackson claimed that the lightning was conducted by the wire to his barn and claimed that that was the cause of the fire. The jury returned a verdict for $9,258. The court held that under the evidence there was only one bolt of lightning, and that bolt was conducted along the telephone wire to Jackson's barn, and fired the barn. The company contended that it was wellnigh impossible that a bolt of lightning striking a hall would be conducted by a telephone wire over a span of at least 300 feet in sufficient quantity to fire the second building. The experts that testified in the case at no point agreed that the second building was fired by reason of the conducting of the bolt of lightning over the telephone wire. The experts for Jackson said that the second barn was fired in that manner, while the experts for the company said it was not fired in that manner. The court accordingly held that the jury had arrived at the conclusion that Jackson's barn had been fired by the wire conducting the lightning and sustained the verdict.

The company contended strenuously in that case that it should not be held to anticipate that the barn would be burned because of the wire being attached to it. They claimed that out of all the barns and buildings in the State only a very few had been burned by being struck by a bolt of lightning. But the court, in answering this contention, said that in electrical storms it was very probable that a barn, on which a wire had been attached, might be burned.

In Starr vs. Southern Bell Telephone & Telegraph Company, 72 S. E. Rep., 484, the telephone company removed a telephone from Starr's house, but for its own convenience left the wires leading into the porch connected with the system with the loose ends twisted together and hanging down about eight inches from the plate of the porch. The company removed the lightning arrester and severed the ground connections. One afternoon Starr was sitting on the porch when a storm came up. Starr arose to go into the house to escape the elements, and, as he stood up, the twisted ends of the wires being about eighteen inches

above his head, a bolt of lightning struck him on the back of the head, rendering him unconscious and injuring him severely. The court held that the company was negligent in leaving the wires in the condition they were in and in severing all ground connection. It was the duty of the company, when they removed the telephone, to take away from the premises everything that in any way would or could cause injury.

The Southern Bell Telephone & Telegraph Company operated its system in and near Eufaula, Ala. Mr. Thomas owned a store building situated in the open country at the intersection of two well-traveled public highways leading to and from Eufaula. Thomas used the building for the sale of various articles, and the public were invited to visit and remain there. The company's poles, at this point, carried the wires at a height of about 30 feet. There were two wires running from a pole near the house into the house. The ends of these wires had been left hanging from the inside of the wall of the building, near a much-frequented part thereof. They reached to within five feet of the floor. On June 30, 1900, Miss Lizzie McTyer came into the building to transact some business. She sat in a chair about four feet from the hanging wires. A severe thunderstorm arose, and she was severely injured by a bolt of lightning which came into the building over the telephone wires.

The evidence in the case showed that Thomas had a telephone in his store, but that some time prior to June 30, 1900, the telephone had been taken out. The company had only removed the instrument, leaving the wires in the position they had been. Thomas, the occupant of the building, insisted that the company remove all its equipment, but the representative of the company only twisted the wires together and left them hanging. The company contended that its representative examined the wires after the accident and found that they were smooth as though they had been cut, and they claimed that if a current of electricity flowed through the wire sufficiently strong to jump four feet and injure Miss McTyer that it would fuse the ends of the wires or split them into threads.

The court held that in view of the well-known capacity of the wires to carry dangerous currents of atmospheric electricity, the company owed a plain duty to Thomas and to his customers and any others who might lawfully be on the premises to remove the wires and obviate the danger. No man of ordinary prudence would have left the ends of the wires in such condition. There being no need of the wires in the building the company should have immediately removed them.—Southern Bell Telephone & Telegraph Company vs. McTyer, 137 Ala., 601.

In the case of Home Telephone Company vs. Fields, 43 Southern, 711, the company had maintained a telephone system to Toulminville, but this branch had been abandoned for some time and most of the wires and poles had been removed. Several wires, however, had been left dangling down through the branches of a tree. The Mobile Light and Railroad Company operated a trolley system in Mobile and through one of its poles ran an eye-bolt that supported the span wire. The span wire was heavily charged. On the outer edge of the eye-bolt was a nut which had a round and square face, and between the nut and the pole was a washer. One of the Home Telephone Company's loose wires dangled into the space between the nut and the washer and from thence down to an iron fence. Robert Isbie touched the fence, was shocked and killed.

The court held in this case that it was the duty of the Home Telephone Company to look after its equipment and remove it or care for it in a proper manner. The span wire was not supposed to be charged, yet the court held that even though the telephone company did not anticipate that it would be charged, nevertheless its wire caused the injury.

Undoubtedly, an atmospheric discharge is frequently conducted through electric wires and accordingly is liable to injure whoever comes into contact with such wires. In attempting to protest their former customers, public-utility companies may do one of two things: they may remove the service entirely, including all equipment; or they may only cease to render service. But if they merely cease service, their duty to protect all persons who come near any of the equipment is not lessened; and, as shown by the Caglione case, the company is positively negligent in permitting current to flow after the termination of the service. The question of wires being good conductors of lightning may have been ruled on too severely by the courts, especially in the McTyer case, yet the decision of the court shows to what extent the company is liable. The company's contention that if the bolt of lightning was strong enough to jump four feet and severely injure a woman it surely would have fused the wires or at least split them seems very probable, yet the very fact that the company permitted its equipment to remain in an apparently unsafe condition fixed the negligence of the company.

Abandonment of the equipment does not relieve the company of liability. This was demonstrated fully in the Fields case, and the application of that rule may well be used where companies cut off the service at the meter or at a junction outside of a building.

Interesting Cases.

MUNICIPAL SUPPLYING OF ELECTRICITY FOR MOTIVE POWER.—It was contended before the Supreme Court of California that the business of supplying electricity for motive power is a private business not within the scope of municipal purposes for which, under the State constitution, municipal corporations may be organized. But the court can see no ground for any distinction in this respect between the use of electricity for power and its use for heat and light, for which purposes counsel admitted that cities may distribute it if authorized by law. It has come to be in common use in homes for the operation of light machines such as sewing machines and suction cleaners, and its supply for this use was also conceded to be a proper municipal purpose. The fact that it may also be furnished to persons desiring to apply it to larger machines for manufacturing or other business purposes is no sound reason for holding such distribution to be without the scope of municipal powers. The business of supplying water for irrigation, or for the watering of stock, is a purely business purpose, as distinguished from domestic use, but it has always been recognized as a public service in which cities may engage. Electricity for power comes within the same category. The Legislature has recognized this fact, and has granted the power of eminent domain to persons and corporations proposing to supply electricity for general use for power.—Clark vs. City of Los Angeles, 116 Pac. R., 722.

DUTY TO GUARD AGAINST INVASION OF FOREIGN CURRENTS.—The Missouri Court of Appeals says that, in the construction and maintenance of its leads and lines, a telephone company was bound to anticipate the likelihood of contacts between its wires and those carrying powerful currents, and even ordinary care imposed on it the duty of doing all that a reasonably careful and prudent person in its situation would have done to guard its uninsulated wires against the invasion of foreign currents. The knowledge that wires are susceptible to injury from storms charged the company with the duty of anticipating that such storms might cause a short-circuit between its wires and others carrying high currents. Telephone wires break or sag down

from a variety of causes, and the company should have anticipated the likelihood that its uninsulated wire, charged with a death-dealing current, might at any time be brought so low as to endanger the safety of pedestrians.—Goodwin vs. Columbia Telephone Company, 138 S. W. R., 940.

BREACH OF LIGHTING CONTRACT.—In the case of the Redlands Home Gas & Electric Company against the city of Colton for breach of lighting contract, the Superior Court has rendered a decision in favor of the city. The Redlands Company acquired a lighting contract granted by the Board of Trustees of Colton to Seth Hartley. Upon the Board rescinding such contract and awarding same to the Southern California Edison Company, the Redlands Company instituted suit for damages.

SWITCHBOARD TAXABLE AS REAL ESTATE.—A special term of the Supreme Court of New York, Steuben County, holds that a switchboard and appurtenances should be assessed as real property in the village of Bath, where located, rather than as personal property in the city of Buffalo, where the company has its home office, although the switchboard is located on premises held only under a 10-year lease.—People on relation of Federal Telephone & Telegraph Company vs. Longwell, 131 N. Y. S., 361.

LIABILITY OF CITY OPERATING ELECTRIC LIGHT PLANT.—In operating an electric light plant, furnishing electric lights for pay, a city, the Court of Appeals of Georgia holds, is engaged in a private, nongovernmental business, and is liable to one injured through the negligence of its employee engaged in repairing wires. For example, a cause of action was set forth against a city by a petition in which it was stated that the plaintiff was injured, while standing on the sidewalk in front of his store, by being struck on the head by a metal instrument attached to a rope which an employee of the electric light plant operated by the city had attempted to throw across certain electric wires which he was engaged in repairing, which were 15 or 20 feet above the sidewalk.—Adepe vs. City of Thomasville, 72 S. E. R., 478.

CONSTRUCTION OF GRANT.—Where a grant of a city to a telephone company was that its petition for "permission * * * to erect telephone poles in different streets of the city and to carry wires across the city bridge was presented and granted," the United States Circuit Court, in Kentucky, says that it will not be disputed that this also included the permission to stretch wires on those poles, and not only to erect the poles and stretch the wires, but to maintain and operate the line after it had been erected. And, the grantee having expended $90,000 in erecting a line under the grant, the court holds that the city could not revoke the grant upon 90 days' notice, either immediately after the erection and putting in operation of the line, or after a lapse of 30 years, there being no constitutional or statutory restriction on the length of such grants when that one was made.—East Tennessee Telephone Company vs. Board of Councilmen of the City of Frankfort, Ky., 190 Fed. R., 346.

LEGAL DISCOUNTS BY TELEPHONE COMPANY.—The Court of Appeals of New York answers in the affirmative the question of whether a telephone company, with an exclusive right to use the streets of the city of New York in order to carry on its business, might make a discount of 25 per cent from its usual charges for telephone service, in favor of the city itself, regularly incorporated charitable institutions, and regularly ordained clergymen, without entitling all its other patrons to a like discount for service of the same kind. The court says that, according to the common law, as in force prior to recent legislation on the subject, the discriminations in question were neither unreasonable nor unjust as matter of law, because they were in favor of the public, and because the favored classes were in a different situation and were surrounded by different circumstances from those affecting the general patrons of the company.—New York Telephone Company vs. Siegel-Cooper Company, 96 N. E. R., 109.

RIGHTS BETWEEN MUTUAL VOLUNTARY TELEPHONE ASSOCIATIONS.—Whatever the rule may be as to telephone companies engaged generally in public service, the Supreme Court of Iowa declares that it cannot be said that a mutual voluntary association, organized and operated for the exclusive benefit of its own members, is bound to extend such membership, or to furnish a connecting line for others. And where one such association connected its line with that of another such association, under an agreement that such connection should be only temporary, and subject at all times to the will of the latter association, the court cannot see how the first association could claim an irrevocable license, and it does not believe that any case can be found in the books so holding. Moreover, while it might be said that the first mentioned association's action in connecting its line with the other association's line, after it had been disconnected by the latter association, was but a mere trespass, still a suit for injunction would lie to prevent future wrongs of the same kind.—Dumont vs. Peet, 132 N. W. R., 955.

DUTY TO PROTECT AGAINST OTHER WIRES BREAKING.—Where a city, in operating a municipal light and power plant, was conveying along a public alley a deadly current of electricity for lighting and power purposes and had permitted a telephone company to maintain its poles and wires upon the same public alley and in close proximity to the electric light wires and directly above them, the United States Circuit Court of Appeals, Eighth Circuit, says that the city must be held to have known, and to have anticipated, that the telephone wires might break and fall upon or near to its light wires, that employees of the telephone company would be required to examine and inspect its wires to keep them in a proper condition of repair, and that others would be upon its public streets; and it was its duty to exercise reasonable care, to prevent injury to third parties rightly upon the street. It was also a fair and reasonable inference that a broken telephone wire received its charge of electricity from the light wires, at a place where the insulation had in some manner been worn from them, when it was not a live wire, when a telephone lineman first picked it up and began pulling the slack out of it.—Finch vs. City of Ottawa, 190 Fed. R., 299.

Water-Power Sites Withdrawn.

Water-power site reserves were created in Arizona, California, Idaho, Oregon and Utah during January by presidential proclamation on recommendation of the United States Geological Survey, covering 9,311 acres. This action was taken in furtherance of the policy of withdrawing all public lands found on examination to possess value as power sites, pending legislation by Congress to allow development by leasing or otherwise. The total withdrawals outstanding on January 31, 1912, embraced 1,726,375 acres, including several thousands of water-power sites.

During January 7,275 acres previously withdrawn were, on further examination, restored to entry as having no value for the development of power. The original withdrawals of power-site lands, as recommended by the engineers of the Survey, are invariably made as small as possible, but where more detailed field examination shows that they can be further cut down without endangering the interests of the public such excess areas are immediately restored to the public domain. Thus, of the nearly 2,000,000 acres which have been withdrawn during the last four years for power sites, 184,383 acres have been restored.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within one week of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions

No. 48.—Opening of Circuit-Breakers During Thunder Storms.—In our plant we were troubled greatly during thunder storms by switchboard circuit-breakers opening. Was this caused by the line wires swinging together and thus causing a short-circuit or was it an effect due to lightning?—G. K., Tulsa, Okla.

No. 49.—Compound Exciters.—Does a compound-wound exciter give better regulation for a three-phase alternator than a shunt-wound exciter? If not, what are the reasons for its use?—L. A. C., Lansing, Mich.

No. 50.—Rewiring Fan Motor.—I have some 108-volt, 120-cycle, alternating-current fan motors. How can I change their wiring to make them suitable for 60-cycle current?—R. G., Sault Ste. Marie, Ont.

No. 51.—Return-Call Bell System With One Wire.—There is one wire running between two buildngs about half a mile part. Is it possible to connect up a return-call bell system on this one wire, and, if so, how may it be done?—W. V. S., Jersey City, N. J.

Answers.

No. 38.—Wound Rotor for Induction Motor.—How is the rotor of a three-phase induction motor wound so as to have only two slip rings? I recently saw one whose speed can be regulated by changing grid resistances in series with the rotor, but it had only two slip rings, whereas I think it should require three.—D. T., Highland Park, Ill.

Although the following does not refer to a motor with wound rotor in the generally accepted sense of the term, it may throw some light on this question. A three-phase revolving-field generator will run as an induction motor, if the field is short-circuited through a field rheostat and current supplied to the stator. In starting it is necessary to use a compensator or to bring the motor up to speed before throwing in the running switch. The speed can then be varied by adjusting the rheostat. The motor will not run much below synchronous speed, however. We recently installed such a generator of 160 kilowatts and used it as a motor to drive the line shaft while the old steam engine was taken out and a new one installed. It operated perfectly during the four weeks required to change engines and is now running as a generator and supplying current to individual motors which we are cutting over from the line shaft.—W. C. L., Chicago, Ill.

No. 44.—Instruments for an Exciter Circuit.—Is it considered poor practice to dispense with the voltmeter and ammeter on an exciter for an alternator in a small lighting plant? If it is necessary to keep the expense down by using only one instrument, which is it more practical to dispense with, the voltmeter or the ammeter, and why?—G. F. L., Marion, Kans.

Frequently exciters are too small for the load they are supposed to carry; therefore I would consider it poor practice to dispense with the instruments as you would have to guess what your machine was doing. If it is necessary to do away with one instrument, I would think it advisable to retain the voltmeter, because the amperage of the alternator field is nearly constant and if you cut all the resistance in with this field you would have to raise the exciter voltage high enough to overcome this, which may be injurious to the exciter. It seems to me that by keeping the voltmeter you can always see what voltage you are carrying and in this way guard against this strain on the exciter.—E. M. R., Saginaw, Mich.

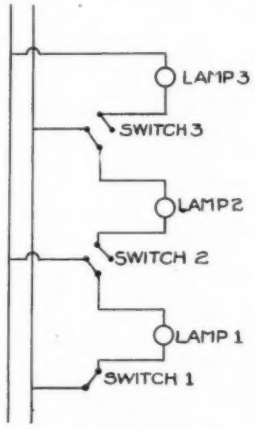


Fig. 1.

If the load does not vary more than 25 per cent on the alternator it is not absolutely necessary to have either voltmeter or ammeter on the exciting circuit, because the voltage of the alternator will not change appreciably within this range, if the rheostat is set for maximum load. If just one instrument is to be used, I should select the ammeter, because it shows the actual current supplied to the field. The voltage of the exciter can remain constant and still the current supplied to the field will vary with the load on the alternator. This variation is shown on the ammeter but not on the voltmeter. A pilot lamp may be used for the exciter in place of a voltmeter.—W. C. L., Chicago, Ill.

No. 45.—Feasibility of Teaching Practical Electricity in Manual Training High Schools.—I should like to get through your questions and answers department some brief expressions from any of your readers that have had experience in teaching practical electrical work in public manual training high schools. Is it feasible to undertake this? If so, what are the conditions that produce the best results?—H. S., Galveston, Tex.

The feasibility of teaching practical electricity in schools has been thoroughly demonstrated to my satisfaction at the manual training high school where I teach. We teach four branches of practical electricity, which are: electrip shop work, armature winding, electrical testing and house wiring. As I teach house wiring particularly, I will explain that phase of the work. At the beginning of our school season the pupils were given class work, drawing, wiring diagrams of bells, annunciator circuits, lights, motors, etc., with general outline of the practical work, tools required, names of materials and inspection requirements in our city. For the execution of the practical work, we constructed of 2 by 4-inch timbers and ⅞ by 10-inch boards, 16 stalls, or separate compartments, 6 by 6 feet and 7 feet high, with a basement or lower floor 3½ feet high, running the entire length of the structure. Each stall now forms one room and basement, having three walls and a ceiling with-

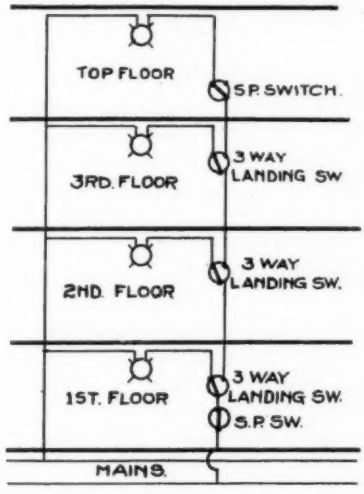


Fig. 2.

out finish, so as to enable us to do open, concealed, conduit, knob and tube work, etc. We work two men in each stall. The first lesson consisted of installing a simple door bell and push, with the battery in the basement. All kinds of circuits are worked out with cleats, knobs, molding and conduit, each installation being complete in itself with feed wires run in, and lights, or motors, installed and tested with current. Great interest is manifested in the work by the pupils, and we believe we are getting good results from our efforts.—A. C., Chicago, Ill.

No. 46.—Combination Switch for Stairway Lights.—Is it possible to arrange the circuits and switches in a stairway so that as one goes up the stairs he may, by means of a single switch on any landing, turn off the light on the next landing below and at the same time turn on the lamp on the next landing above?

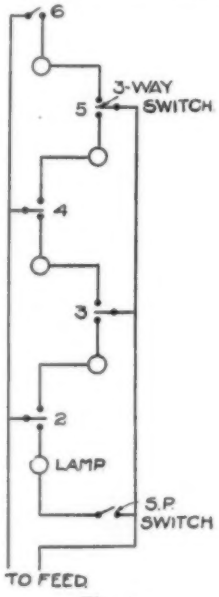


Fig. 3.

If so, what is the proper arrangement of circuits?—J. S. C., Detroit, Mich.

Solution 1.—I would wire these stairway lights as shown in Fig. 1, using double-pole rotary snap switches except on the first floor, where a single-pole switch will do. In going up, lamp 1 is lighted by closing switch 1. Switch 2 on the next landing turns out lamp 1 and at the same time lights lamp 2. Likewise, turning switch 3 puts out lamp 2 and lights lamp 3, and this could be continued for any number of floors. Lamps on alternate floors may be lighted at the same time, but the switches should be operated in regular order to secure the lighting scheme desired in going up or down.—W. C. S., Philadelphia, Pa.

Solution 2.—The switching arrangement for stairway lights in this question may be obtained by the use of single-pole switches at the bottom and top of the stairway and three-way switches at the intermediate floors or landings. Fig. 2 shows the connections. The switches must not be tampered with and must be turned only by the person going up and then coming down.—R. W. E., Chillicothe, O.

Solution 3.—A set of three-way and single-pole switches can be used to operate the lights in this way, as shown in Fig. 3. This arrangement is also reversible and can be used when coming down stairs. There is a single-pole switch at the lower landing and another at the top landing, so that the current may be turned on when starting up stairs and turned off when the top landing is reached and vice versa. This arrangement, however, does not provide for a second person coming up, nor for a person stopping at an intermediate landing. The operation of the switches is as follows: single-pole switch at top closed, and single-pole switch at lower landing open, and all three-way switches on lower contacts. On going up, turn switches 1, 2, 3, 4, 5 and 6 in turn; the last switch turns off the last light. The reverse order is followed in coming down.—W. C. L., Chicago, Ill.

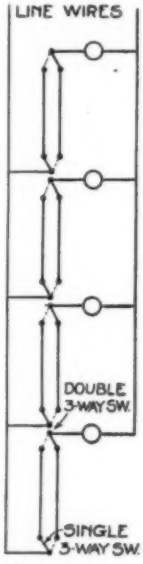


Fig. 4.

Solution 4.—In wiring these lights I would provide a single three-way switch at the bottom of the stairway and one at the top and a double three-way switch at each landing. The latter switches could be made by connecting two three-way switches so they operate together. The wiring is shown in Fig. 4. A simpler arrangement can be made by wiring single three-way switches throughout, but that does not permit a number of persons to follow each other going up the stairway, while the arrangement in Fig. 4 does. It also works going up or coming down.—A. L. U., St. Joseph, Mo.

Solution 5.—As I understand this question, it should be possible to have a light at the head and foot of each flight of stairs, and when reaching the former to turn out the bottom light and at the same time turn on the top light of the next flight without disturbing the light at the floor that the person has reached. The scheme shown in Fig. 5 does this by means of three-way switches at the intermediate floors and single-pole switches at the top and bottom. I have shown the latter (S1 and S5) to be each two independent switches to permit the first two and the last two lights to be turned on or off separately, but a single switch will do in each case. S1 lights both L1 and L2, S2 cuts off L1 and lights L3, S3 cuts off L2 and lights L4, and so on. A similar procedure follows when going down.—V. B., Milwaukee, Wis.

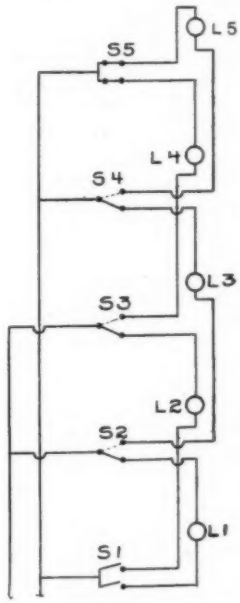


Fig. 5.

Wireless Telephony Through the Earth.

It has been announced that an official of the German Post Office Department, Herr Kiebitz, has successfully carried on telephonic communication between Berlin and Canada, by means of Hertzian waves through the earth, no aerial being employed. The impulses are transmitted by means of a special generator giving 100,000 cycles per second. The wires connected to the transmitting instrument are carried to two plates imbedded in the earth at a definite distance apart equal to one-half wave-length of the electric waves employed.

Electrolysis.

At the weekly luncheon of the New England Section of the National Electric Light Association at Boston on February 9, Albert F. Ganz, of Stevens Institute of Technology, gave an illustrated lecture on "Electrolysis." About 350 persons attended, and Irving E. Moultrop, mechanical engineer of the Edison Electric Illuminating Company of Boston, presided. Professor Ganz pointed out that electrolysis is chemical decomposition by means of electric currents. The decomposition and resulting destruction of underground piping and cable sheaths from electrolysis due to stray current will be discussed here. In practice the only sources of serious stray currents are single-trolley direct-current electric railways. In these railways current is supplied from the positive terminal of the dynamo to the cars through the overhead trolley wire, passes through the car, and then is returned through the running tracks. The rail lengths constituting the running tracks are therefore bonded across their joints so as to make them electrically conducting. In the neighborhood of the power station, the tracks are connected to the negative terminal of the generator, thus completing the electric circuit. The running tracks of such single-trolley railways are usually in contact with the ground, and since the earth is a conductor of electricity, current will leak from these rails and flow through it. Such currents are called stray or vagabond currents. Since electric current can only flow in a closed circuit, all stray current which leaks from rails and flows to ground and to underground pipes and lead cable sheaths, must again leave these underground structures in the neighborhood of the railway power station in order to flow back to the negative terminal of the generator, so as to complete the electric circuit. Where this stray current leaves these underground pipes or cable sheaths to flow to ground, electrolytic corrosion is produced, resulting in a destruction of 20 pounds of iron or of 60 pounds of lead in one year for every ampere of current. Since current does damage only where it leaves pipes or cable sheaths to flow to ground, attempts are frequently made to prevent this corrosion by connecting or bonding the pipes or cable sheaths by means of metallic wires to the negative return circuit, and so remove the electric current by metallic conduction and prevent corrosion from electrolysis. This generally protects cable sheaths because they form continuous electrical conductors, but is not generally applicable to water and gas piping systems, because these do not form continuous electrical conductors, but more or less discontinuous metallic network. Such bonding plans for protecting underground structures always greatly increase stray currents, and render the bonded structures a part of the negative return circuit, and therefore a source of danger to other underground structures which are not bonded. It has, in fact, frequently been found that where gas or water service pipes cross bonded cable sheaths, currents are induced to flow from the service pipes to the cable sheaths and produce gradual destruction of the service pipes. This method of protecting underground structures should therefore be used only with great caution. Experience shows that where there is serious trouble from electrolysis due to large stray currents leaking from street railways, the bulk of this trouble is due to defective rail bonding, to ground connections from the negative terminal of the generator, and to lack of return feeders for bringing current back from the rails to the power station. While stray currents can only be entirely eliminated by insulating the return circuit by the use of a double trolley, either overhead or in conduit, it is nevertheless a fact which is not generally appreciated, that where large stray currents exist, these can frequently be reduced to a small fraction of their value by removing all ground connections of the negative terminal of the generator, and installing insulated return feeders from radially disposed points in the track system located at some distance from the power station, and so draining the rails of current at these points. In Europe, such insulated return feeders for bringing current back from the rails to the power station are made necessary by regulations limiting the allowable drop in potential in the rails, and in most cases such installations of insulated return feeders have eliminated all serious trouble from electrolysis. This system of minimizing stray currents by means of radially disposed insulated return feeders has also been installed in a number of American cities, and the method is gradually being recognized as by far the best for reducing serious stray currents to a negligible value. This system in fact removes the root of the trouble, by draining the rails of current and thus preventing substantial leakage of current through ground, and the method is therefore correct in principle. Where large stray currents flow on underground piping systems, it is frequently found that current will enter a building by, say, a gas service pipe, flow from the gas to the water piping through house conections, and then flow out of the building by the water service pipe. Such connections between service pipes in buildings are frequently made through metallic ceilings, or where the pipes rest against each other, and where currents of considerable magnitude flow from one pipe to another in this way, they form a serious fire hazard, because any vibration tending to separate the contact will produce an arc which can set fire to inflammable material nearby. It, therefore, seems wise to apply only such methods for remedying electrolysis as will result in removing the cause, namely, result in eliminating currents through ground.

Electrolysis from stray electric currents is an enginering problem of no small proportions in which all parties interested should co-operate. If the railway companies would apply as much enginering and money to their negative return systems as they do to their positive feeder systems there would be very litle trouble from electrolysis. The important features are: high rail conductivity, minimum rail drop, high resistance from rails to ground and to pipes, and high resistance along the lines of pipes. The railway companies should assume the burden of providing proper return conductors for the current used on their railway system. The co-operation of the pipe-owning companies is necessary both to the investigation and sometimes to the cure, as it frequently is both proper and necessary to increase the resistance to current along pipe lines by insulating joints, or by covering pipe lines with sufficiently thick coats of insulating material at local points. The practice of promiscuously bonding pipes to rails to cure electrolysis must be unqualifiedly condemned. There are cases where, after a railway company has an adequate return circuit, current from continuous underground metallic conductors, such as lead cable sheathing and some pipe lines, may be removed by bond connections from the pipes to the negative return circuit, but such connections must be controlled and regulated and only small currents must be allowed to flow through such bond connections.

Wireless Station at Panama City.

The Government of Peru will erect a wireless-telegraph station at the federal capital, the apparatus and material for same to be imported from the United States.

Approval of Wireless Telegraph Convention.

The Congress of the Argentine Republic has approved the wireless telegraph convention signed in Berlin on November 3, 1906.

The government of Portugal has also ratified the provisions of the radiotelegraphic convention.

SANGAMO AMPERE-HOUR AND WATT-HOUR METERS.—I.

By Joseph B. Baker.

The mercury-contact meters made by the Sangamo Electric Company, utilizing liquid mercury to lead current into and out of a rotating disk, and to float the disk in lieu of a jewel step bearing, giving a net upward thrust against an inverted step bearing at the top of the spindle, are shown in the accompanying illustrations, Figs. 1 to 5. The watt-hour meters comprise house service and switchboard meters for direct and alternating current, and also test meters and meters for recording the power consumption of street cars. This company also makes ampere-hour meters of the mercury-contact type for electroplating operations and for electric vehicles (the "auto-type" meter)[1] and the control of storage-battery charging in central-station work.

All of these meters are designed with a rotating element consisting of a simple copper disk floated in mercury with a slight upward thrust against a jewel bearing. The progress of improvement has included endeavors to eliminate or compensate for the fluid friction of the mercury on the rotating disk; and an important feature is the minimizing of friction by insuring that the level of the mercury is well above the top of the float so that the only friction surface at the surface of the mercury is the periphery of the shaft, which is relatively very small, as the shaft is of small diameter. Creeping of mercury along the surface of the copper electrodes is prevented by nickel-plating the outer ends of the electrodes, as nickel will not amalgamate with mercury. This disk is traversed by current which is led through it by mercury contact with the edge of the disk; and the armature current reacts with the flux generated by a fixed field winding, causing rotation of the armature.

The commercial Sangamo meters, in order of their development, comprise: a type C direct-current meter (the first meter made by this company in the United States); a type D direct-current meter which is the present direct-current standard; a type D alternating-current meter; a type E alternating-current meter, and a type F alternating-current meter which is the present alternating-current standard.[2]

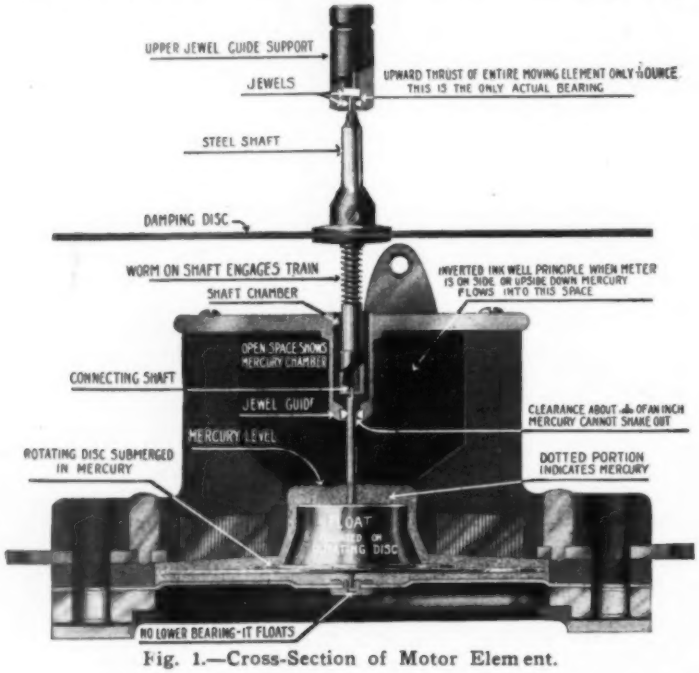

UPPER JEWEL GUIDE SUPPORT
JEWELS
UPWARD THRUST OF ENTIRE MOVING ELEMENT ONLY 4 OUNCE. THIS IS THE ONLY ACTUAL BEARING
STEEL SHAFT
DAMPING DISC
WORM ON SHAFT ENGAGES TRAIN
SHAFT CHAMBER
INVERTED INK WELL PRINCIPLE WHEN METER IS ON SIDE OR UPSIDE DOWN MERCURY FLOWS INTO THIS SPACE
OPEN SPACE SHOWS MERCURY CHAMBER
CONNECTING SHAFT
JEWEL GUIDE
CLEARANCE ABOUT 1/64 OF AN INCH MERCURY CANNOT SHAKE OUT
MERCURY LEVEL
ROTATING DISC SUBMERGED IN MERCURY
DOTTED PORTION INDICATES MERCURY
FLOAT
NO LOWER BEARING-IT FLOATS

Fig. 1.—Cross-Section of Motor Element.

The design and operation of these meters will be clear from the following description.

The Sangamo type D meter displays the most characteristic features of the mercury-contact meter, the employment of this liquid metallic conductor for leading the current into the disk and for floating the disk, the latter being completely submerged. Fig. 1 is a vertical section of the upper part of the motor element, and Fig. 2 a view of the complete meter. In Fig. 1 the load current is led into the mercury bath by means of the two binding-posts attached to electrodes which project through the walls of the molded-insulation chamber opposite the ends of a diameter of the disk, their amalgamated ends bathed in the mercury, and passes through the disk from edge to edge. With this arrangement the copper disk is, of course, shunted by the mercury; nevertheless, most of the current traverses the former on account of its relatively higher conductivity. Whereas, in the "C H" ampere-hour mercury meter the rotation is due to the reaction between a varying load current traversing a Faraday-disk armature and a fixed magnetic field, in the Sangamo watt-hour mercury meter the fixed field is furnished by a wound electromagnet. The elementary diagram, Fig. 3—a vertical section on the axis of the spindle—shows the principle of this meter. *D* is the mercury-submerged copper disk (mercury omitted for clearness). The current which traverses this disk along a diameter of same is led into and out from the mercury bath by the submerged terminals *A, A*. The fixed magnetic flux causing rotation by reaction against the current traversing the disk is generated by the wound, laminated U-magnet *M*, supported underneath the motor element and with its poles facing up and having oppo-

Fig. 2.—Service Meter.

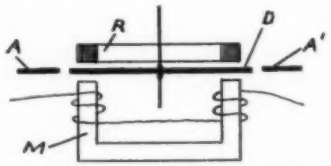


Fig. 3.—Diagram of Watt-Hour Meter.

1 The present article refers to meters in which the mercury conducts armature current; the type H Sangamo induction meter was described in an article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for March 18, 1911.

2 The author was recently advised by the Sangamo Electric Company that the first American mercury-type meter, the type C, was brought out by that company late in the fall of 1904, after about one year's experimental work subsequent to the discontinuance of the manufacture of induction meters of the old Gutmann type for the American trade. This type C meter followed somewhat the lines of European practice in mercury meters, except that it had a potential winding, instead of a permanent magnet as used in the Hookham and other English mercury meters. Having no permanent magnetic field acting on an auxiliary disk, or anything equivalent thereto, it was really an ampere-hour meter instead of a watt-hour meter; since the variation in damping effect of the shunt field, due to varying voltage, upon the copper armature in the mercury was such that it just about balanced the variation in torque, giving a practically constant speed for a given amperage at any voltage over a wide range, instead of a speed varying correctly with the wattage.

site them the laminated ring *R*. This ring thus serves as the return path for the lines of force generated in the U-magnet.

The operation is the same as already described for the C H ampere-hour meter. The continuous torque causing rotation is produced with alternating current as well as with direct current; since with the former the changes in magnetization of the field are made to occur in phase with the changes in current flowing through the disk, this will exert a rotating effect upon the disk the same as with direct current.

The actual construction of the motor element is further elucidated by Fig. 4, which is a view with a quarter segment of the molded-insulation case or mercury receptacle cut away and mercury omitted. A small quantity of mercury is held in the receptacle by a thin pressed metal plate fastened mercury-tight against the bottom of the receptacle by a heavy brass clamping ring, leaving a very shallow circular space for a thin disk armature which is thus immersed in mercury. In all Sangamo meters the armature floats in the mercury bath, a small non-metallic float being riveted to the center of the submerged copper disk in order to give the necessary buoyancy (unaffected by all ordinary changes of temperature of the mercury) to slightly over-counteract the weight of the entire moving system including the parts above the submerged disk. The upward pressure against the jewel is made about 3 grams (0.1 ounce). A large ring jewel surrounds the lower (or inner) spindle where the latter passes through the gland of the mercury chamber, with a clearance of 0.001 to 0.002 inch, and a small ring jewel serves as a guide for the upper end of the upper (or outer) spindle where the same presses against a flat end-stone at the top; and there is also a jewel guide ring at the bottom. It is claimed that the aggregate wear of these bearings is inappreciable and breakage of jewels unknown.

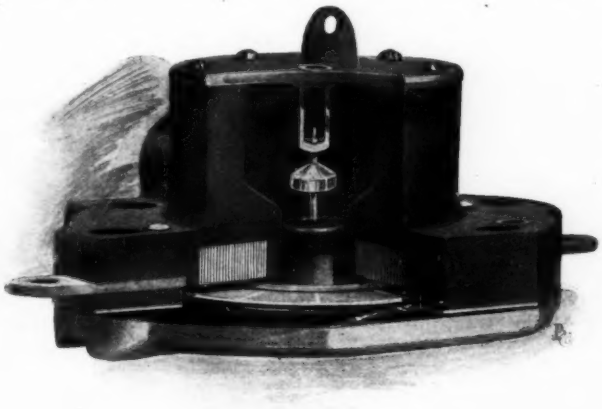


Fig. 4.—Mercury Container Cut Away to Show Construction.

Sangamo meters are shipped filled with mercury, and accordingly an effectual means of confining the mercury must be provided. Spilling of the mercury is prevented by the "invertible inkstand" construction shown in the illustrations. (See particularly Fig. 5.) The top bearing piece carrying the flat end-stone jewel is adjustable by means of a micrometer screw back of same. The proper setting allows an end-play not exceeding 0.015 inch, equivalent to three-quarters of a turn of the adjusting screw. Moreover, in case of a sudden jar or shake of the meter, the armature submerged in its heavy liquid medium operates like the plunger of a dashpot.

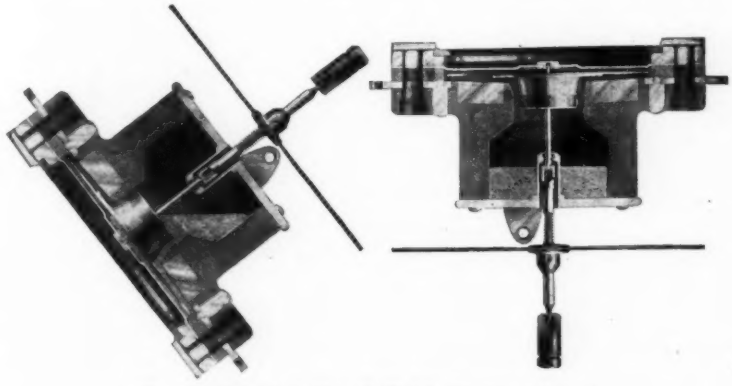


Fig. 5.—Showing Non-Spillable Construction.

The general design of this meter being clear from the foregoing, the actual construction and operation of the direct and alternating-current types of meter will now be taken up. At the outset it may be stated that the functions of the fixed field and the moving armature are reversed in the two types. In the direct-current meter the field is excited by the voltage of the circuit and the armature carries the load current; and in the alternating-current meter the field is excited by the load current and the armature is traversed by a current due to a permanently connected potential transformer of small dimensions.

In the direct-current meter, the U-magnet core carries a pair of fine-wire potential coils having about 14,000 turns. This winding produces a field proportional to the voltage at the terminals of the consumer's load. The load current, or a shunted portion of same, passes through the copper mercury-immersed armature. The reaction between the armature field due to the load current and the fixed field due to the voltage gives therefore a torque proportional to the power—so that with the other necessary elements, the damping disk and permanent magnets, and the recording train—an integrating or watt-hour meter is constituted. The operation of large-capacity meters of this type with shunts is one of the characteristic features. The current passing through the meter proper is in all cases limited to 10 amperes (the determined maximum rated full-load current through the mercury-immersed armature); and in the measurement of loads exceeding 10 amperes a shunt is provided to take the excess current. This means that this small-size meter can be used to measure any current load from 10 to 20,000 amperes, by connecting the meter in on a board equipped with the proper shunt to carry the bulk of the current—just as in the installation of an indicating ammeter—and that the meter proper can be removed at any time to check its accuracy or make any other necessary repairs, without disturbing the service or the main wiring. Internal shunts, readily removable and interchangeable, are employed in meters of 20 to 80 amperes capacity, inclusive. For meters of higher capacities, separate shunts of three different types—the so-called pocket, box and open types—are installed.

The voltage drop in the 10-ampere meter without shunt is stated to be 0.03 volt at full load (drop between main binding-posts). In the 20 to 80-ampere meters with internal shunts, the full-load drop is about 0.06 volt; and in capacities employing external shunts the drop through the shunt is standardized at 75 millivolts at full load—the higher drop being due to the resistance in the cables connecting the meter to its shunt.

(To be continued.)

New Electrical and Mechanical Appliances

The Unity Insulator for Telephone and Telegraph Lines.

The Minerallac Electric Company, 112 West Adams Street, Chicago, has developed a novel form of combined insulator and pin that has recently been placed on the market under the name of Unity insulator. These insulators are turned out of a solid piece of tough wood to exactly the shape desired, including one petticoat. The insulators are thoroughly impregnated with Minerallac insulating compound which also has excellent wood-preserving properties. Insulators of this general type of construction have been in use on the high-tension lines of a large central-station company for about eight years, being subjected to line voltages of 4,000, 9,000 and 12,000 volts. During this prolonged try-out period they have shown no deterioration in insulating qualities nor any tendency to crack or split.

Unity Insulator.

The chief advantages of this insulator are its unbreakability both in shipment, installation and service; economy of installation, since the insulator and pin are in one piece; high insulating qualities, the insulation resistance being found to decrease only a few per cent under the most severe storm conditions.

A great difficulty that telephone and telegraph companies have had has been from malicious destruction of glass insulators by hunters, small boys, and anyone carrying a gun in the country who seem to have taken keen delight in making the insulators objects of target practice. The new type Unity insulators have been found to withstand bullets, shot and missiles of any kind. The insulators are extremely tough and thereby make the element of breakage practically insignificant. The insulating compound does not ooze out appreciably even when the insulator is subjected to great heat, as for instance in the arid districts of the Southwest, where the hot sun might be thought to produce a bad effect on these insulators. The insulators are easily packed and shipped at low cost compared to the ordinary glass or porcelain insulator, and are in themselves no more expensive than the latter. A large number of telephone companies have ordered them in the short time they have been placed actively on the market.

Faries Shade-Holder.

Exhibition by Capitol Engineering Company.

An electrical exhibition is being prepared by the Capitol Engineering Company, Lansing, Mich., to be held in its store and adjoining rooms during the second week of March. The exhibit will be open to the public without charge and space will be accorded free to all exhibitors of electrical apparatus. Current will also be supplied free of charge for operating purposes. Applications of electricity of interest to the public, both for residence and industrial purposes, are to be included in the display, especially lighting fixtures, heating and cooking apparatus, vacuum cleaners, washing machines and lamps.

The New Faries Shade-Holder.

The Faries Manufacturing Company of Decatur, Ill., has for a long time been known as the manufacturer of a great variety of fixtures and fixture parts for electric and gas lighting. Included in this category are its adjustable electric brackets, portables, and shades of practically every description. The company recently brought out a new form of shade-holder which is a considerable improvement over those that have very commonly been in use. It is made of solid brass and has three fingers, one inch wide, that snap over the bead on the socket. A ring is provided that acts as a lock nut. With the holder in place the shade can be swiveled freely and yet not be pulled off. The holder has such a firm grip on the socket that in the case of adjustable bracket or desk lamps it has been found that the fixture could be pulled about to please the user by grasping the shade. Formerly this was not possible because the clips would release their hold on the socket and allow the shade to drop off.

Shade and Holder.

The new shade-holder is very rapidly applied, however. One quarter turn of the locking ring secures it firmly to the lamp socket, and a reverse quarter turn releases it instantaneously. The shade and holder are attached in such a way that there is no need for screws or any parts to become loose.

The Westinghouse Combination Dynamotor-Compressor.

The Westinghouse combination dynamotor-compressor is a machine for use on 1,200 and 1,500-volt direct-current motor cars and locomotives. It performs the functions of both dynamotor and compressor, furnishing half voltage for the operation of the control and lighting circuits, and in addition drives the air compressor when necessary. The dynamotor is connected between trolley and ground, and operates continuously. When the air-reservoir pressure falls below a certain predetermined value, the compressor is automatically connected to the dynamotor by a clutch. When the compressor raises the air pressure to a predetermined maximum value, the clutch is automatically disconnected and the compressor stops.

The usual arrangement for 1,200 and 1,500-volt equipments consists of a high or low-voltage motor for operating the compressor, and a continuously running dynamotor for supplying current at half voltage (600 or 750 volts) for lights and control, and for the low-voltage compressor motor, if such is used. The Westinghouse dynamotor-compressor performs the duties for which the two machines were formerly required and, as a result, there is a saving of about 900 pounds in the weight of the equipment, and there are fewer parts and only one machine to maintain.

In sections where the trolley voltages are 600 or 750, the dynamotor connections are changed (see Fig. 1) by throwing a canopy switch so that the dynamotor becomes a compressor motor operating with one winding on half voltage and at normal speed, thus driving the air compressor at normal speed. Full air pressure is therefore assured on all interurban and city sections. The straight 1,200-volt motor-driven compressors operate at only half speed when on the half-voltage sections of a road, and are often incapable of delivering sufficient air to provide for the frequent city stops.

The methods used for lubricating the machine are ingenious and effective. Splash lubrication is used for the compressor cylinders, pinion, gear, clutch and the bearing adjacent to the clutch. The oiling is continuous. The crank case is maintained about half full of oil and the compressor cranks, in splashing through, break up the oil into small drops. Some of it is thrown through a hole in the gear case and onto the gear. The gear carries it over to the pinion, which throws a portion on the clutch and a portion on the waste in a lubrication pocket over the adjacent armature shaft bearing. The waste is saturated and the surplus drains back through a duct to the crank case to be used again. The armature-shaft bearing adjacent to the commutator is lubricated by means of an oil-well-and-waste arrangement similar to that used on Westinghouse railway motors and therefore only filtered oil is fed to the shaft.

The dynamotor has two separate armature windings on the same core, each connected to a commutator. When the dynamotor is connected across 1,200 or 1,500 volts, the two windings are in series, so that each takes one-half of the trolley voltage. Each armature winding is in series with a field winding. A shunt-field winding is connected across the leads of the low-voltage armature to maintain the speed approximately constant.

The magnet frame is a single steel casting. Large openings, closed with bearing housings, are provided at each end of the frame, through which pole pieces, field coils and armature can be removed. Tight-fitting commutator hand-hole covers are furnished. These have machined seats and easily operated locking levers. Dynamotors and compressors are machined to templet and are interchangeable. Field coils are vacuum impregnated with a waterproof and heatproof compound, and are thoroughly insulated. Metal-coil shields provide protection and spring-coil supports prevent vibration and chafing.

The armature coils are form wound and insulated with the highest grade materials. For protection against grounding, U-shaped insulating pieces are held in widened slots at the end of the core and extend one-half inch beyond it. Bolted commutators are used and creepage distances to ground are usually long. The armature bearings are solid bronze shells. The brush-holders are mica-insulated. Brush tension is uniform throughout the life of the brush. Braided shunts carry the current from the hammer tip to the holder so that a very small amount

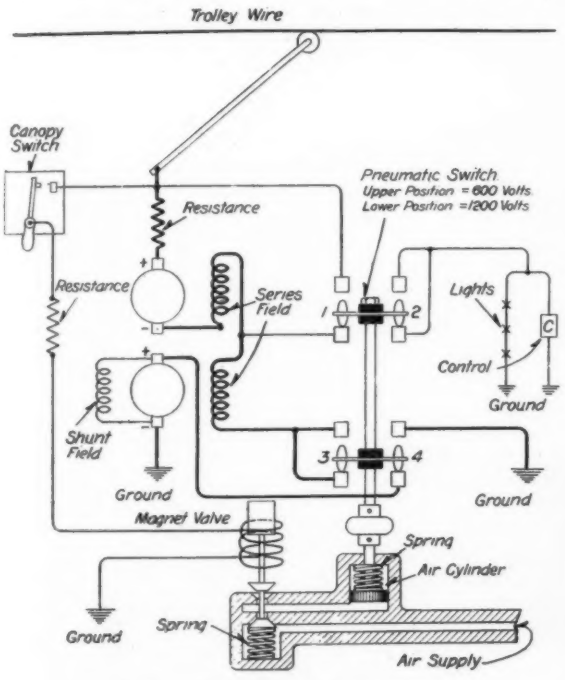


Fig. 1.—Diagram of Connections.

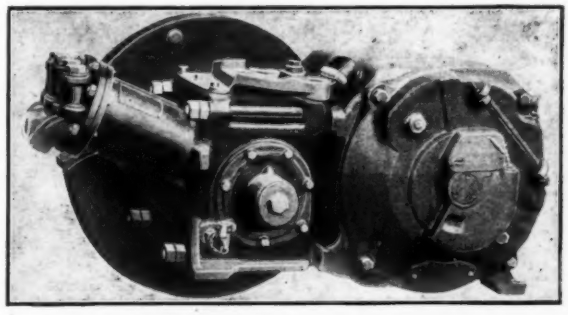


Fig. 2.—Westinghouse Dynamotor-Compressor.

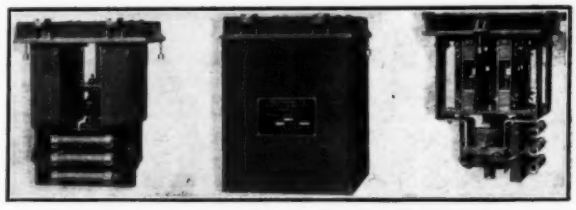


Fig. 3.—Three Views of Change-Over Switch.

passes through the springs. The gears are cast steel with 1.5-inch face.

The compressors are made by the Westinghouse Air Brake Company, Wilmerding, Pa. They are similar in general design to the compressors that this company has so successfully manufactured many years for electric-railway service. One excellent feature is the placing of the cylinders at an angle, which insures effective splash lubrication and thorough drainage. In Fig. 2 the compressor is shown at the left and the dynamotor at the right.

A modified type-N air-pressure governor of the general design that has long been successful in electric-railway service operates the dynamotor clutch indirectly. There is no electric switch on the governor, as an air valve is used instead.

An improved form of the multiple-disk clutch, that has given excellent service on automobiles, is used. When the air-pressure governor acts, set for some predetermined pressure, it opens a valve admitting air to the cylinder adjacent to the clutch. A piston in this cylinder operates against a heavy spring in such a way as to disengage the clutch. When the tank pressure reaches a minimum value, the air in the cylinder is automatically released by the governor, the spring closes the clutch and the compressor starts. The clutch is engaged when there is no air pressure so that the reservoir can always be filled.

A switch for changing the dynamotor connections from those for 1,500 to those for 750 volts (or from 1,200 to 600 volts) is provided when desired. It simultaneously changes the control and lighting circuit connections from the dynamotor terminals to the trolley. This change-over (Fig. 3) is pneumatically operated and controlled by a canopy switch located in the cab. It consists of a single magnet valve and a pneumatic cylinder similar to those used on Westinghouse switch groups. It carries a double pair of contacts which establish the proper dynamotor and auxiliary-circuit connections. Normally, this switch is held in the high-voltage position by a powerful spring. But, when desired, it can be held in low-voltage position by the admission of air to the pneumatic cylinder. In case of a failure of either air or electric power, the switch automatically returns to the high-voltage position, which is the safe one at all times.

Free Entry of Wireless Material Into Peru.

The Congress of Peru has passed a law exempting from payment of duty material imported for the official wireless-telegraph stations.

Duraduct.

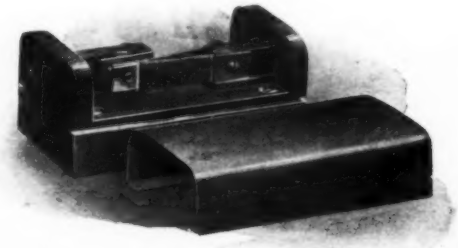
The Tubular Woven Fabric Company, of Pawtucket, R. I., has recently put on the market a non-metallic flexible woven conduit called "Duraduct." The principle embodied in the construction is entirely new The wall of the tubular fabric is built up of an outer surface of hard twisted insulating paper and an interior surface of woven cotton, these three layers being interwoven to form a single wall that is inseparable.

It is claimed that kinking, looping, flattening or twisting the fabric even in cold temperature does not affect the interior, for when straightened the inside diameter remains the same with no blisters or obstructions for the wire.

The weave is such as to possess extreme flexibility together with great tensile strength and non-abrasion qualities and is peculiarly adapted for holding the compounds making it both flame-proof and moisture-proof. The interior surface is of unique design, being a rounded-point surface which allows the wires to slide over with much less friction than over a flat or line surface.

Motorless Lamp Flasher.

Kelley & Kelley, Brooklyn, N. Y., is placing upon the market a small flasher for use with stereopticon or decorative lamps wired in series up to 32 lamps. The ends and base are made of porcelain so that in wiring no bushings are required. The cover slides on and it covers the entire flasher so that no casing is required. The contacts are made of platinum and the heating wires are covered with fireproof material. This flasher is entirely automatic. It is motorless, springless and contains no wheels or similar mechanism. It may be used on either direct or alternating-current circuits of voltages up to 220 volts.



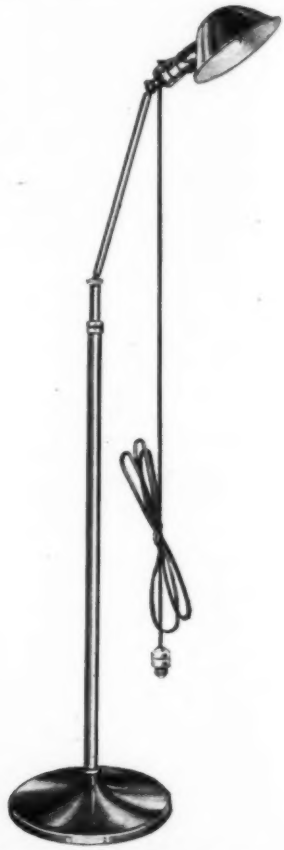
Thermo-Blink Flasher.

A Novel Electric Heater.

An English firm has placed on the market an electric heater which is in the form of a round metal plate, decorated with artistic designs. The heating unit is placed in the center, while the metal plate serves not only the purpose of adding to the ornamental value of the heater, but to radiate the heat as well.

A New "Badger" Floor Portable Lamp.

In the office of every doctor and dentist, in hospitals and sanitariums, and in operating rooms where modern mechanical appliances are installed, the electrical industry has supplied some of the most useful and, today, indispenable accessories. In diagnosis and in practice no natural element is so essential as good lighting for the physician, surgeon, oculist or dental practitioner. Artificial lighting, however, is more advantageous than natural light because of the steadiness of the illumination and the ability with which the practitioner can direct the light to the point of desired application without establishing upon his own part either fatigue or the disarrangement of physical apparatus. For specialized lighting for physicians, surgeons, oculists and dentists, and in fact for every kind of service of this nature, the Vote-Berger Company, LaCrosse, Wis., has placed on the market the "Badger" floor portable lamp shown in the accompanying illustration. The lamp can be adjusted to



Badger Portable Floor Lamp.

hundreds of angles and positions. It is equipped with a twelve-inch arm attached to the portable by means of ball and socket joints which render perfect swivel adjustment of the arm and socket. The lamp standard is adjustable from a height of three and one-half feet to six and one-half feet from the floor. It is equipped with a round metal base made with spun brass over cast-iron, ten inches in diameter. The standard is seven-eighth inch in thickness, and is finished either in brush brass or Japanese bronze. The standard is equipped with ten feet of flexible silk cord, a two-piece separable attachment plug making it easy to attach to any fixture without twisting the cord.

New Selling Arrangements for Excello Flaming Arc Lamps and Excello Flaming Carbons.

The Körting & Mathiesen Company, sole designers and manufacturers of Excello flaming arc lamps, announces that in order to meet the growing, country-wide demand for the Excello flaming arc lamps and Excello flaming carbons, and so that it might give closer co-operation to the electrical engineering and illuminating industry, the Excello flaming arc lamp and Excello flaming carbon will be marketed exclusively by Körting & Mathiesen, Inc., George W. Armstrong, general manager. Headquarters have been established at 22 East Twenty-First Street, New York, N. Y. The company has a capital of several million dollars and a factory capacity of 60,000 arc lamps annually. The company has been manufacturing Excello arc lamps for the last ten years and through its technical director and its organization, has developed a highly efficient and economical flaming arc lamp and carbon.

George W. Armstrong, who becomes general manager of the company, has been one of the most active and enterprising exponents of the flaming arc lamps in this country and for years was western manager of the Excello Arc Lamp Company of New York. Mr. Armstrong is a native of Ohio and was for some time a successful business man in that state. He established his first connection with the flaming arc industry in 1906, opening the office of district manager of the Excello Arc Lamp Company in Columbus, O. He was at that time salesman and agency organizer of the company and in February, 1908, was sent to Chicago by the company to establish the western office.

George W. Armstrong.

In this connection, Mr. Armstrong carried out a number of notable installations of Excello flaming arc lamps, some of the largest steel mills and other industrial plants being his customers.

Mr. Armstrong will make his headquarters at the head office in New York and will be assisted by a strong organization of illumination experts, many of whom have for a long time been closely identified with the marketing of the Excello lamp.

National Coating.

The corrosion of pipe, conduit and other iron or steel materials at points where they are exposed to moisture or electrolysis is a matter that has given considerable trouble to those responsible for the maintenance of such installations. The life of underground pipe is a very uncertain quantity, unless some adequate protection is furnished. National Coating is a system of protection which has been applied to pipes ranging in size from 3 to 18.5 inches in outside diameter, and preparations are being made to extend it to all sizes.

The National Tube Company, Pittsburgh, Pa., makes use of the following process in applying National Coating. The pipe is first cleaned and dried, and while still at a temperature above the boiling point of water, it is dipped into a hot bath of special refined bituminous compound and kept there until the pipe has the same temperature as the bath. On removal from the bath the pipe is allowed to drain vertically and cool, leaving the pipe covered inside and outside with an elastic compound, the consistency of which can readily be adapted to the temperature conditions under which the pipe is to be used. By a second operation this enamel-like surface is wrapped with a strip of fabric which has been thoroughly saturated with the hot compound. Immediately after being saturated with the compound the fabric is wound spirally over the surface of the pipe, overlapping about one inch on each turn, covering and firmly adhering to the body coat. Two or three thicknesses may be applied in this way where desired to meet special conditions. The average thickness of ordinary paints or bituminous dips rarely exceeds one-hundredth inch, but in the case of one-ply National Coating the thickness of protection amounts to about three sixty-fourths inch.

It is, of course, necessary to leave the ends of each length unprotected by fabric until the line is assembled. It is very important before the pipe is finally covered to see that all the joints are properly protected by compound and fabric, and that any places that may have been damaged by abuse in handling are repaired.

The advantages of the National method lie in its perfect exclusion of moisture. A heavier coating of the protecting material can be applied when it is reinforced by fabric. The

Method of Applying National Coating.

saturated fabric also affords protection against mechanical damage, and serves to hold the foundation coat in place. When the wrapping has been injured, it can be readily repaired in the field.

Localized Machine Lighting.

A new and novel localized lighting device has recently been placed on the market by the Permel Sales Company, of Warren, Ohio. The main feature of this system is a fixture rigidly attached to the machine and supporting a reflector socket of thick brass, which contains a miniature Mazda lamp.

The fixture consists of a small heavy brass tube bent to fit closely to the body of the machine and holding rigidly in its proper place a special scientifically designed reflector socket. The fixture is made in one solid piece, and it is impossible to jar loose either the fixture itself or any of its parts.

The Mazda lamp is one inch in diameter of especially strong design, having a drawn-wire tungsten filament which consumes but 5.5 watts on the six-volt circuit and gives very satisfactory life. The lamp is fitted with an Ediswan candelabra base which prevents the lamp unscrewing from the socket by vibration. With the reflector used, 8.7 candlepower is directed towards the place where the actual operation is being performed.

The wiring is simple. From the fixture a flexible cord leads through the bench to a six-volt circuit supplied through a voltage-reducing device. The flexible cord makes it possible to throw back the head of the machine, if necessary, without removing the fixture from the machine. The low voltage used decreases the danger from fires or accidents and allows the wiring to be done at low cost.

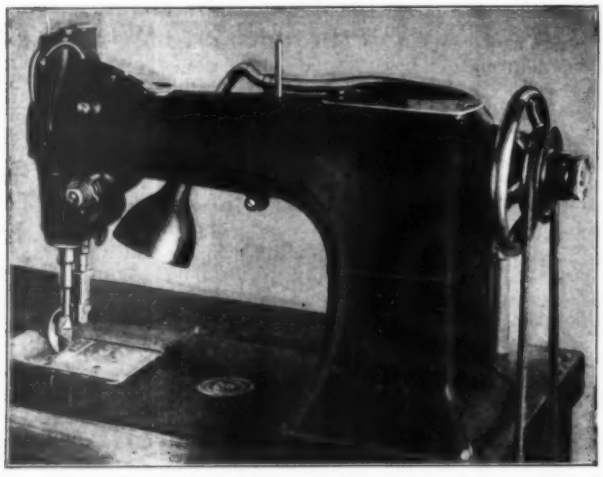
For reducing the line voltage (usually 110) the following systems are recommended: Small transformers of 125-watt capacity, capable of supplying 23 machines, are connected to the alternating-current lighting circuit at any convenient point or by means of plug connection to an outlet already installed if desired. The transformers can be installed under the bench out of the way, and the six-volt mains run under the bench to the machines. In this system each lamp is independent of all others and can be switched on or off, or removed, without affecting others.

Where the power available is direct current, it may be converted into alternating current to facilitate transformation to low voltage. This can be done by means of a small rotary converter or motor-generator set; the former is recommended owing to reduced cost. The rotary converter can be placed near the panel board, or in case of private power plant, in the engine room. The lighting main already installed could probably be isolated to serve as distributing main for the low-voltage alternating current. The transformers can be placed under the bench and the six-volt mains run to the machines. By use of the transformer recommended, the two foregoing systems are interchangeable.

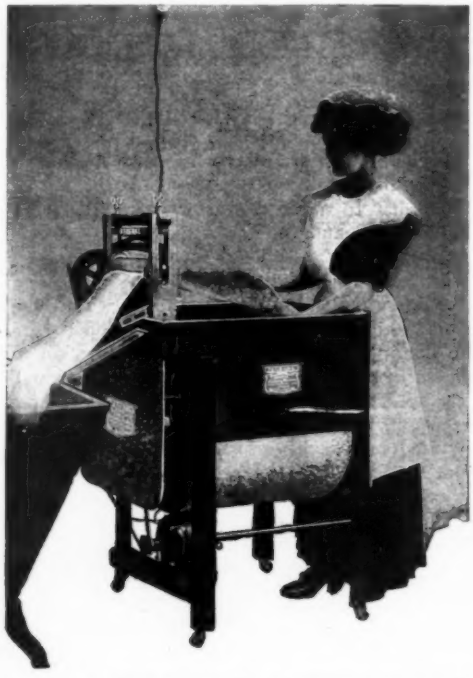
In some special cases, it may not appear desirable to purchase the rotary converter or transformers. In such cases the series system can be used, at a reduced cost of installation, but with less flexibility. In this system, the fixtures are wired in series on a circuit drawn from the power mains at any convenient point. The total number of lamps to be connected in series should be governed by the voltage of the circuit, and for this system six, seven or eight-volt lamps can be furnished, if desired.

The light from the lamp being directed toward the working surface and not into the operator's eyes, allows the operator to work without eye-strain or fatigue, and thereby turn out much more work and work of a better quality than when any other lighting system is used. The illumination received on the work is 25 to 50 times that usually received. The operator cannot get in his or her own light.

The system is sure to have a wide field of application where specific lighting is essential, as in shoe factories, clothing factories, collar and cuff factories and other small machine lighting.



Permel Fixture for Localized Lighting.



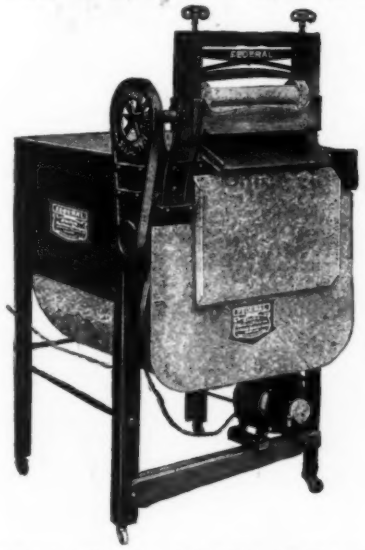
The Federal Electric Washing Machine in Service.

The Federal Electric Washing Machine.

The continually growing demand for lightening household labors has stimulated the development of many electrically driven washing machines. A new device of this character has been manufactured by the Federal Electric Company, of Chicago. This machine is very simple, as but two levers are necessary for controlling it. One of

these starts the motor to oscillating the perforated clothes cylinder, and the other is used in starting a reversible wringer. The clothes receptacle or cylinder is made of perforated zinc and has wooden end walls. It oscillates at the rate of 35 times per minute, thus thoroughly forcing the water through the perforations in and around the cylinder. The wringer is equipped with high-grade rubber rollers.

Power is provided by a constantly running motor, the control levers connecting merely transmission gears and clutches. The gears and motor are under the wringer and are covered by a galvanized apron which completely protects them and also guards against personal injury or damage to the clothes. The entire machine is very compact and is built of seasoned maple, steel lined throughout so as to provide a very substantial construction. A particularly valuable feature of the wringer is the perfect control that is



Federal Electric Washing Machine.

possible. This prevents the tearing of delicate fabrics, such as laces and fringes.

The company is prepared to show that its electric washer is not only an efficient but very economical device, and will result in an annual average saving of something like $20 over the old method of employing a more or less unreliable laundress. These washers have been placed on the market by the Federal Sign System (Electric), 501 Home Insurance Building, Chicago.

Shurlok Lamp-Socket Locking Device.

The introduction of high-efficiency incandescent lamps has brought about several peculiar problems, one of which is to find some definite way to prevent the theft of these valuable lamps. This difficulty has been found particularly aggravating by companies renting tungsten lamp clusters or similar fixtures, in many cases not only the lamp but the shade as well having been spirited away. Lamp-socket locks have been developed for some time, which have served their purpose in a way but have not been entirely satisfactory because the lock provided was easily picked with a hairpin, toothpick, or something of that character, which the cunning of those with malicious intent has been able to devise.

To meet the requirements more adequately, Pass & Seymour, of Solvay, N. Y., have developed a locking device under the trade name of Shurlok. As shown in the illustration herewith this is a very harmless-looking appliance, but has been found very serviceable. Its particular feature is in the special key which is required. These keys may be obtained from the manufacturers only, and then in only limited quantities so as to prevent them from getting into general circulation. They are not sent out as samples. A number of large central-station companies, who have employed this locking device, have found that by means of it they

The Shurlock Device.

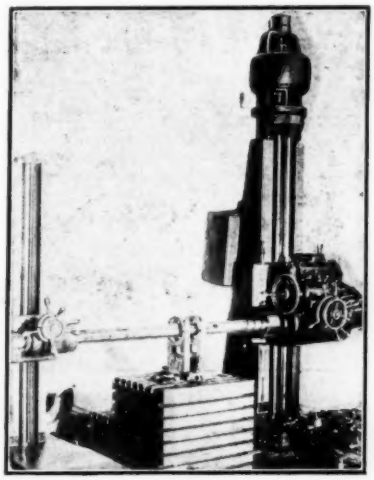
have been enabled to reduce the maintenance cost of clusters and other rented lamps quite materially.

The Shurlok device may be applied to any Protectus or Passmour type of key, keyless, or pull sockets and receptacles. They protect not merely the removal of the lamp, but also that of the shade as well. The company is prepared to send out samples of the Shurlok device, but in these the locking device is somewhat different from that provided for the standard sockets. The sample keys cannot be used to remove lamps from the regular sockets. This is being done to safeguard against the unauthorized possession of the keys for regular use.

Vertical Motor Drive for Boring Machines.

Progressive manufacturers are always cognizant of the importance of selecting an efficient drive for their machine tools. They readily perceive that the most direct or shortest distance between the source of power and the work means not only more work with less power, but also reduced operating costs by eliminating many superfluous lines of shafting with belts to each machine, dripping oil, and the difficulty of speed changing. By the use of individual electric drive the machines may be located in the most convenient places for the work they are to perform, rather than in a row and driven from one line shaft. The economy and flexibility of individual motor drive cannot be too greatly emphasized, since this form of furnishing power has been largely responsible for the increased output of many varied industries.

In the building of machine tools, another important factor which is usually given careful consideration is the saving of floor space. This opens a new field for the electric motor by mounting directly on the top of the machine to be driven. The electric motor is ideal for this purpose and has found especial favor with machine-tool manufacturers due to its adaptability to direct mounting. It matters little whether the motor is mounted on a movable or stationary part, the drive



Vertical Motor on Boring Mill.

will be equally efficient. High mounting also affords the operator plenty of space, and at the same time keeps the motor remarkably free from dirt, chips and loose particles which often fall into the motor and do considerable damage.

A particularly interesting and somewhat unique example of the manifold advantages of individual motor drive applied to machine tools is shown by the accompanying illustration. This horizontal boring machine is built by the Rochester Machine Tool Company, of Rochester, N. Y. The motor is a five-horsepower vertical type-R machine made by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. The method of mounting the motor on the top of the column has proved very satisfactory.

Commutating-Pole Rotary Converters Becoming Popular.

Rotary converters with commutating poles are being more generally used by large central-station companies. The Westinghouse Electric & Manufacturing Company report several recent large orders for such substation equipment.

The New York Edison Company has ordered two 3,000-kilowatt, 25-cycle, vertical, regulator-type, commutating-pole, rotary converters delivering 270 volts direct current, and two 2,300-kilowatt, three-phase, 6,600-volt primary, air-blast transformers. The contract also includes four 3,500-kilowatt, 25-cycle, 270-volt, direct-current, commutating-pole rotary converters with four 3,850-kilowatt, three-phase and three 1,285-kilowatt single-phase, air-blast, 5,600-volt primary step-down transformers.

Electric Automobile Lighting a Pullman Train.

The Edison Electric Illuminating Company of Brooklyn has ordered seven 1,000-kilowatt, 25-cycle rotary converters delivering direct current at 270 volts, and 21 400-kilowatt 6,600-volt primary air-blast transformers. These rotaries are designed to give a buck or boost of 15 per cent of the normal voltage. This order in the result of the satisfactory operation of sixteen rotaries of this type previously ordered.

The Long Island Railroad Company has ordered two 1,500-kilowatt, 600-volt direct-current, 25-cycle, commutating-pole rotary converters with six 550-kilowatt, oil-insulated, self-cooled, 33,000-volt primary transformers; also a 2,000-kilowatt, 25-cycle rotary converter with commutating-poles, and three 750-kilowatt, single-phase, oil-insulated, self-cooled, 33,000-volt transformers; also one 2,000-kilowatt, rotary converter with non-commutating poles of same rating as the one described above, with three 750-kilowatt, 11,000-volt primary, single-phase, air-blast transformers. This equipment is to be used to take care of additional load on the existing lines of the railroad company.

Electric Automobile Supplies Lights for Pullman Train.

The illustration shown herewith shows an interesting incident in connection with the automobile races held in Savannah, Ga., last November. The Pullman Company had run several special trains there from different parts of the country, and these were sidetracked adjacent to the race course. The train shown here was equipped throughout with electric lights. Because of some trouble in the generating mechanism no light could be obtained. The Savannah Electric Garage & Tire Company, agents for the Waverley electric automobiles, was consulted by the Pullman officials, and asked to suggest some method of furnishing power for the lights. In this extremity a Waverley electric automobile was connected up to the train, as shown, and all lights were furnished by this arrangement, to the entire satisfaction of the passengers. After this unique experience the automobile was driven back to the garage on its own power.

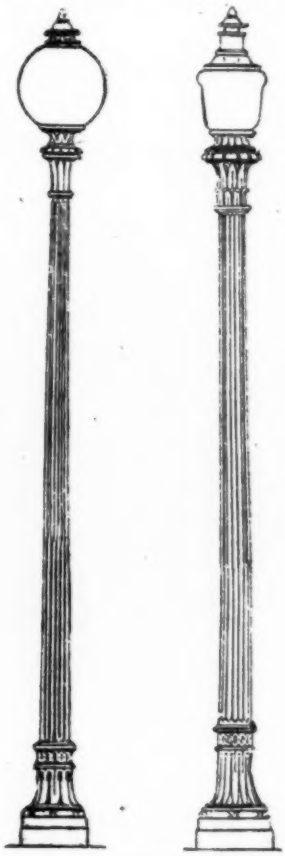
Government Ownership of Electric Plants.

A bill has ben introduced into the Congress of Uruguay for the nationalization of the electric supply of the Republic. One of the arguments advanced in favor of the plan is the present results of the municipally-owned power house of Montevideo, which has grown from 148 subscribers in 1890 to 12,664 at the close of 1911. If the bill becomes a law, it will affect the privately-owned electric plants at Salto, Minas, and other cities.

New Lamp-posts for Baltimore.

The Municipal Art Commission of Baltimore has adopted a new design for lamp-posts to be used in the city. They differ widely from the designs used throughout the country. George A. Miller, the lighting expert who came to Baltimore to help solve the city's lighting problems says: "The new designs are ahead of anything I have ever seen and I shall urge its adoption in other cities.

"Instead of using the plan in general use which calls for heavy cone columns to support a light lamp the commission has taken the flambeau for its model. The new posts are slender and in keeping with the weight they are supposed to support. One of the posts is for tungsten lamps and the other for arcs. No permits for others will be issued in the future.



Baltimore Lamp-Post Designs.

Electrically Heated Glove.

An electrically heated glove has been invented to supplement the electric foot warmer which has been in existence for some time. Arthur L. Careon, of Binghamton, N. Y., has patented a glove or mitten in which is incorporated an electric conductor provided with electrical contacts which are exposed at points in the glove surface.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

EUSTIS, FLA.—It is planned to greatly enlarge the power plant at Eustis.

CROSBY, N. D.—The citizens of Crosby are agitating the erection of an electric light plant.

LOUP CITY, NEB.—The Loup City Mill & Light Company has been given a 20-year franchise here.

WATSONVILLE, CAL.—The Coast Counties Light & Power Company will shortly extend its lines to Corralitos.

EDGAR, NEB.—R. T. Williams and others propose to build a power plant and furnish electric current to this city.

MILES, TEX.—The electric light plant here which was recently destroyed by fire will be rebuilt and enlarged. D.

CARLTON, ORE.—The city officials have been instructed to issue bonds not to exceed $40,000 for light and water purposes.

KERSEY, COLO.—The Kersey Ice Company intends to build an electric lighting and power plant here, if it is granted a franchise.

HOUGHSONVILLE, N. Y.—The Town Board is considering the request of the citizens here to furnish Houghsonville with electric lights.

ANAHEIM, CAL.—The city contemplates the installation of an ornamental street-lighting system on Center and Los Angeles Streets. A.

GADSDEN, ALA.—The Gadsden Car Works will install an electric light plant and make other improvements, at an estimated cost of $20,000.

ROSEVILLE, CAL. — The city plans the installation of a municipal electric power system. A power plant will be erected at an early date. A.

SALT LAKE CITY, UTAH. — The Earle Power Company has been incorporated with $250,000 capital stock. C. W. Earle is president of the company.

VAN NUYS, CAL.—The Edison Electrical Company plans the construction of a power line to furnish the city of Van Nuys with light and power.

SUPERIOR, ARIZ.—The Magna Copper Company contemplates the installation of new air compressor machinery. Work will be commenced at once. A.

GLENDALE, CAL.—The city has voted bonds for improvements and additions in its municipal electric lighting system. The expenditure will be $40,000. A.

MOUNTAIN HOME, IDA. — The Shoshone & Twin Falls Water & Power Company will increase the capacity of its power plant at Shoshone Falls, Idaho.

RENO, NEV.—W. G. Douglas has been granted a franchise by the Washoe County Commissioners for an electric power line between Reno and Carson City.

EMPORIA, KANS.—The Emporia Railway & Light Company has recently voted $30,000 for increasing the capacity of its plant to approximately 1,200 kilowatts.

MINNEAPOLIS, MINN.—The Council Committee on Health and Hospitals plans to extend the territory of the Tenth Ward street lighting system in the near future.

READING, PA.—Peuckert & Wunder, engineers and architects, Philadelphia, are taking bids on a new power plant and engine house for the Reading Brewing Company.

DEWITT, NEBR. — The Dewitt Light & Power Company has been organized and subscriptions amounting to $10,000 obtained for the erection of an electric light plant.

TUCUMCARI, N. M.—The city is considering plans for the enlargement of the electric light and power plant. A new building in which to house the equipment will be erected. D.

CATLETTSBURG, KY. — Big Sandy Electric Company has been incorporated with a capital stock of $5,000. The incorporators are C. W. Poling, F. F. Fisher and S. B. Warnock.

ELMA, WASH.—F. W. Murphy, Dayton, O., and C. C. Brown, Olympia, are negotiating for the Wynooche power site with the intention of building a power line in the Chehalis valley.

GOLD RUN, CAL.—The United Water & Power Company, recently incorporated, with James D. Stewart, as manager, plans for the erection of an electric power system.

JACKSONVILLE, ILL.—The Jacksonville Gas & Electric Company has been incorporated to operate a utility plant. The incorporators are E. W. Fowler, Fred G. Buffe and H. E. Chubduck. Z.

LONDON, ONTARIO.—The London Street Railway Company has instructed Manager C. B. King to obtain tenders on a new steam power plant. The company intends to expend about $75,000.

UNION, S. C.—The City is arranging for the construction of a transmission line to the City pumping station, a distance of three miles. R. A. Easterling is manager of the electric light plant.

ROSEVILLE, CAL. — The City Trustees have passed a resolution ordering the city engineer to draw plans and specifications, and to advertise for bids for the construction of a municipal power station.

ST. PAULS, N. C.—The St. Pauls Light & Power Company will open bids March 1 on the erection of an electric light plant and grist mills to replace those recently burned. A 60-kilowatt generator will be installed.

ESSEX JUNCTION, VT.—The Burlington Light & Power Company will erect a new dam and power house this spring. The dam will cause a setback of the river about three miles and will make a lake a half mile in width.

HEMET, CAL.—Bids will be received up to March 27 for the purchase of a franchise granting the right to operate an electric pole, tower and wire system for a period of 50 years along the public highways of the town.

LOS ANGELES, CAL.—The City of Los Angeles has closed a contract with Speyer & Company, New York City, for the sale of $9,390,000 4.5-per cent bonds, $3,500,000 of which is for the erection of an electric light plant.

ALLEGAN, MICH.—The Commonwealth Power Company is planning to spend thousands of dollars in improvements to the Allegan electric plant. New poles, wires and transformers as well as new machinery will be installed.

LAWRENCEBURG, IND. — A. D. Cook is negotiating for the furnishing of electric lighting to the suburb of Greendale. Jacob M. Bauer, whose name is used in connection with this project, announces that he is not connected with it.

SANTA ROSA, CAL.—The Great Western Power Company has been granted permission by the City Council for the construction of electric power lines in Santa Rosa. The company contemplates furnishing the city with light and power. A.

FAIRVIEW, S. D.—The Sioux Valley Power Company is making arrangements for harnessing the Big Sioux River at this place and power development work will soon commence. About $80,000 has been raised to push the work.

PENDLETON, ORE.—The interior Electric Power Company, recently organized by the citizens of Pendleton, and Milton, Ore., has acquired a site and will soon commence the erection of a power plant to furnish light and power to both cities. A.

DANIELSON, CONN.—Work is to be started at once on the new pole line which is to convey the electric current, supplying power and lights for Danielson from the plant at Plainfield. A 500-kilowatt generator is to be installed in that station.

NORTHAMPTON, MASS.—A special committee comprised of Alderman O. M. Smith and Councilmen W. S. Paden and M. K. Crooks and the Fuel and Lights Committee is investigating the "Great White Way" system of lighting for Northampton.

PURCELLVILLE, VA. — Loudon Electric & Ice Company will open bids during March for the installation of a plant to supply electricity for light,

heat and power to Purcellville, Hamilton, Round Hill, Blumont and other towns in Loudon County.

DEMING, N. M.—The Federal Light & Traction Company of New York is investigating the situation here with a view of erecting a large central electric power plant to furnish power for operating irrigation pumps throughout the Mimbres Valley.

RADFORD, VA.—New York and English capitalists, who have purchased the option on the Dominion Power Company under certain conditions, predict a tremendous electric power development for New River below Radford, for which plans are now well under way.

KOOTENAI, IDAHO.—The Kootenai Power Construction Company, which has been organized by Joseph A. Coram, of Boston, has a project under way to harness the Kootenai Falls for the purpose of transmitting electric power to the Coeur d'Alene mines and to various cities, including Spokane, Wash.

WARREN, ME.—The Knox County Power Company has filed articles of incorporation with the Secretary of State, the capital stock being $5,000. The company will supply electricity for lighting, heating and manufacturing purposes in several towns in Knox and Waldo counties.

HAVRE DE GRACE, MD.—The Philadelphia, Baltimore & Washington Railroad is drawing up plans for the erection of a power plant to be located in this city. The plant will furnish power to operate a system of automatic signals and also to furnish light for the company's properties in Havre De Grace and Perryville.

GREENVILLE, MISS.—The Delta Electric Light & Power Company will install additional machinery at an estimated cost of $25,000, including a 500-kilowatt turbine generator, 100-kilowatt turbine generator, 100-kilowatt direct connected exciter, switchboard, three 75-kilowatt transformers, etc.

PITTSBURGH, PA.—The Committee on Lighting of City Council has appropriated $10,000 to be used in changing the present lighting system on a portion of the Northside District. Tungsten lamps are to replace arc lamps. The change will consist of the installation of 100 ornamental posts on Federal Street.

PULASKI, TENN.—The city is having plans prepared for the rebuilding of the electric light plant. The work includes the installation of 125-horsepower and 150-horsepower medium speed, automatic engines, and 75-kilowatt and 100-kilowatt, 2,300 volt, three-phase generators. $20,000 bonds will be issued. C. L. Wheeler is the managing engineer.

LONE PINE, CAL.—The Lone Pine Utilities Company has been organized for the purpose of developing water and power in the Owens River valley near the town of Lone Pine. The directors of the concern are S. B. Wright, Colton; E. E. Denton, E. Carl Crandall, E. S. Field and J. R. Lockwood, Los Angeles. The company is capitalized at $500,000.

SACRAMENTO, CAL.—The United Water & Power Company, of which James D. Stewart, Gold Run, is manager, has under way a big electric power and irrigation project. The company owns water rights on the South Yuba, Bear and American Rivers that are capable of producing 34,800 horsepower. It is estimated that the cost of developing the project will be about $3,000,000.

HIGDEN, ARK. — The Arkansas Hydro-Electric Power Company has filed articles of incorporation with the Secretary of State. The company proposes to build a dam and electric power plant on the Little Red River near Higden. The capital stock of the company is $10,000 and the incorporators are W. L. Thompson, H. F. Fix, E. T. Stanfield, J. D. Arnold, Louis Rosenfield, W. D. Dickinson, Guy A. Watkins and Ben J. Altheimer.

IMBODEN, ARK.—Brewer & Gore, Memphis, Tenn., have purchased the electric light and power plant located at this place. The new owners plan to overhaul the entire plant and install a new boiler and much new machinery.

RED BLUFF, CAL.—City Engineer Luning has been instructed to prepare a report on the probable cost of a municipal water and lighting system. If the report shows that the city can make the improvements contemplated an election will be called for bonding purposes.

WILKINSBURG, PA.—This borough proposes to install the tungsten lighting system to replace the present system of arc lighting. The present contract expires March 1 and an ordinance now in the borough councils will call for the installation of 180 250-watt series tungsten lamps at a cost of $40 per annum. The contract will also call for the privilege of installing 17 100-watt lamps at a cost of $25 per lamp per annum, to be used in lighting alleys. Business men of the borough are contemplating a uniform, ornamental lighting system for private use.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PRENTICE, WIS.—The Prentice Mutual Telephone Company has been organized here.

OGEMA, WIS.—C. C. Engstrand and others propose to incorporate a telephone company here.

HATFIELD, MASS.—Extensive repairs are to be made to the telephone exchange here, including a new switchboard.

HENNING, MINN.—The Henning State Telephone Company has been incorporated to operate in Otter Tail County.

MOLALLA, ORE. — The Molalla Telephone Company has filed articles of incorporation with a capital stock of $2,500.

COHASSETT, CAL. — The Cohassett Telephone Company plans to improve its system between Cohassett and Chico. A.

GOLDTHWAITE, TEX.—The Brown Telegraph & Telephone Company has been incorporated with a capital stock of $15,000.

PLATO, MINN.—The Tri-County Co-Operative Telephone Company has been incorporated with a capital stock of $50,000.

VANCOUVER, B. C.—The British Columbia Telephone Company contemplates the erection of a new exchange plant. A.

PLAINVILLE, TEX.—The Northwest Texas Telephone Company is about to expend $35,000 in various improvements here.

CADDO GAP, ARK.—The Amity Telephone Company has purchased the Caddo Gap telephone exchange and will rebuild the system.

WINSTON-SALEM, N. C. — The Spanish Grove Independent Telephone Company has been granted a franchise to construct a telephone system.

BERKELEY, CAL.—The project of Mayor J. Stitt Wilson for a municipal telephone system has been indorsed by a large number of prominent citizens.

MAUCH CHUNK, PA.—It is reported that the Bell Telephone Company will spend about $6,000 for the establishment of a subscribers' plant here.

SAN JOSE, CAL.—E. D. Franks and others have been granted a franchise for a farmers telephone line from Santa Cruz County to the town limits of Los Gatos.

WINSTON-SALEM, N. C. — The Bethlehem Telephone Company has been granted a franchise to build a telephone system extending fives miles from Walkertown.

ANACORTES, WASH. — The Independent Telephone Company plans the extension of its line from Anacortes to Rosario. Work will be started at an early date. A.

ST. PETER, MINN.—The Nicollet County Telephone Company will install a new central energy system and erect a new exchange building if granted a 25-year franchise extension here.

HIDDENITE, N. C.—South Yadkin Telephone Company has been incorporated with a capital stock of $4,500. D. H. Leener and W. C. Beckham are named among the incorporators.

STEAMBOAT SPRINGS, COLO.—The East Cedar Telephone Company has been organized for the purpose of connecting up the western section of Moffat County over the Mutual lines.

OTHELLO, WASH.—The Othello Improvement Association, of which Frank Fehr is the corresponding secretary, is actively interested in a project to have a municipal telephone system in Othello.

BIRMINGHAM, ALA.—A franchise has been granted to Pickney Scott, J. E. Parsons, Ira Parsons and John Parsons to construct a private telephone system along Fourth Avenue public road.

BRENHAM, TEX.—Randle Hill-Brenham Telephone Company has been organized. William Reich has been appointed president; E. E. Hacker, vice-president; Adolph Dannhaus, secretary; and Andrew Schroeder, treasurer.

PORTLAND, ORE.—The Mutual Telephone Company, incorporated at Seaside, Ore., by W. D. Torrey, Audley Cregg and Charles Williams, has been granted permission to build a telephone line from Seaside to Elk Creek River, Ore. A.

SAN LEANDRO, CAL.—The Pacific Telephone & Telegraph Company, the Postal Telegraph Company and the Pacific Gas & Electric Company have been notified that all power wires within the town limits must be installed underground within 90 days.

WILKINSBURG, PA.—The Bell Telephone Company and the Western Union Telegraph Company have agreed to the terms of an ordinance that provides for the placing of all overhead wires and cables in underground conduits, where traffic warrants the change.

ELECTRIC RAILWAYS.

(Special Correspondence.)

KAMLOOPS, B. C.—The Mackenzie & Mann Company will build an electric line from Kamloops to Okanagan, B. C. A.

MANHATTAN, MONT.—The Manhattan Northern Electric Railway Company will soon commence work on its proposed electric line throughout the Gallatin Valley. A.

FOREST GROVE, ORE.—The Southern Pacific Railroad Company has been granted permission by the city to build an electric branch from the main line to Forest Grove. A.

CENTRALIA, WASH.—The Washington-Oregon Corporation is surveying the traction line between Centralia and Olympia. C. A. Harmony, formerly city electrician, is in charge of the survey.

CANTON, O.—Frank A. McGowan, Canton, and Willis C. Swift, Coshocton, are interested in financing the proposed interurban street car system connecting Newark and Zanesville with Uhrichsville and Dennison.

RICHMOND, IND.—The directors of the Eastern Indiana Traction Company at a special meeting approved the report of a survey for a road between this city and Portland, the directors being assured of all necessary backing.

BALDWINSVILLE, MASS. — The Massachusetts Northern Street Railway Company has been granted a franchise to relocate its track on Elm Street and to extend the line to the Templeton and Winchendon boundary.

RISING SUN, IND.—The officials of the Indiana & Ohio Southern Interurban Company are preparing to advertise for immediate bids for the construction of about ten miles of electric road between Rising Sun and Aurora.

GUELPH, ONTARIO. — W. H. Grant, superintendent of construction for the C. N. R., states that the electric road to be built from Toronto to Gulph will run through Acton, and that construction work will be started this spring.

FALL RIVER, MASS.—The Boston & Providence Interurban Railroad, a new electric line to be constructed between Boston and Providence, is contemplating the extension of the line to this section of the state and touching Fall River.

CLEVELAND, O.—The Mahoning & Shenango Valley Railway & Light Company is contemplating increasing its bonded indebtedness from $10,000,000 to $65,000,000 for the purpose of building a trolley line from Cleveland to Pittsburgh.

ELKHART, IND.—H. E. Bucklen, who operates an interurban line from Elkhart to Angola, announces that he will soon begin the work of extending the line to connect with the Ohio & Western. This will afford traction service from Toledo to Chicago. S.

NEWVILLE, PA.—S. M. Kitzmiller, Shippensburg, is at the head of a movement to construct a trolley line from Newville to Chambersburg via Shippensburg, a distance of 19 miles. Bonds are now being placed on the market for the financing of the project.

NEW BERN, N. C.—It is stated that the Neuse-Trent Traction Company will begin work on the street railway within a short time and that New Bern will enjoy the advantages of a transportation system by May 1. Storage battery cars will be used.

HUNTINGTON, IND.—Promoters claiming to represent the Curtis Construction Company are planning to build an electric road between Goshen and Fort Wayne, with a branch via Columbia City to Huntington, where it will connect with the Cincinnati, Bluffton & Chicago Road. S.

JACKSONVILLE, ILL.—The Jacksonville Street Railway Company has been incorporated with a capital stock of $2,500, to operate street railways in and adjacent to the city of Jacksonville. The incorporators are H. E. Chubbuck, E. W. Fowler, W. J. Achelpohl, Frederick G. Buffe and James A. Knowlton. Z.

HIBBING, MINN.—The Mesba Railway Company has been organized by Boston and New York capitalists to build a high-speed interurban road on the Mesba Range, between Hibbing and Gilbert. The new company will have an initial issue of $1,000,000, first mortgage 5-per cent bonds; $500,000 preferred stock and $1,500,000 common stock.

SAN FRANCISCO, CAL.—The San Francisco & Northern Railway Company has filed articles of incorporation for the purpose of building an electric railway from Santa Rosa to San Quentin. The papers call for a capital stock of $2,500,000. The incorporators are John O. Kittle, Ross; Archibald Borland, Oakland; Frank A. Brush, Santa Rosa; and William L. P. Jackson, Santa Rosa.

CHICAGO, ILL.—The Chicago and Interurban Traction Company has been incorporated with a capital stock of $1,000,000. The line is to be constructed from Kankakee to Chicago. The principal office is at Chicago. The incorporators and first board of directors are Warner H. Robinson, Charles R. Moore, Edgar H. Pank, William W. Crawford and Charles H. Ireland, all of Chicago. Z.

QUINCY, ILL. — The Chicago, Peoria & Quincy Traction Company has been incorporated with a capital stock of $200,000. The principal office is at Quincy. The line is to be constructed from Quincy to Peoria through the counties of Adams, Brown, Schuyler, Cass, McDonough, Fulton and Peoria. The incorporators and first board of directors are John A. Steinbach, Charles Oehlman, August H. Heibreder, H. E. Knapheide and George J. Jost, all of Quincy. Z.

WHITEWRIGHT, TEX. — The Greenville & Whitewright Northern Traction Company has been incorporated with a capital stock of $210,000. The purpose of the company is to construct an interurban line from Greenville through Merritt, in Hunt County, Blue Ridge and Westminster in Collin County, to Whitewright, in Grayson County. The incorporators and first board of directors are A. R. Nicholson, J. W. Castelberry, H. A. Barsun, A. W. Defee, J. E. Morris and W. H James, Greenville, and S. M. Dickens, of Merritt. Z.

PROPOSALS.

ELECTRIC WIRING AND LIGHTING. — Sealed proposals will be received until March 8 by D. L. Stone, Constructing Quartermaster, for electric wiring of the new ward addition and passage to hospital at Old Fort Sill and the electric lighting at the dispensary of New Fort Sill.

ELECTRIC PUSH - BUTTON MAIL LIFT.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 16 for an electric push-button mail lift in the post office and court house, Madison, Wis. Copies of drawing and specifications may be obtained at the office of the Supervising Architect.

ELECTRIC CONDUITS & WIRING.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 20 for electric conduits, wiring and interior lighting fixtures for the post office and court house at Del Rio, Tex.; until March 25 for electric conduits, wiring and interior lighting fixtures for a one-story and basement building to be used as post office at Talladega, Ala.; until March 27 for electric conduit, wiring and interior lighting fixtures for a one-story and basement building for the post office at Paragould, Ark.; until March 30 for electric conduits, wiring and lighting fixtures for a one-story and basement building for the post office at Darlington, S. C. Drawings and specifications may be obtained from the custodian of the various sites or from the office of the Supervising Architect.

NEW PUBLICATIONS.

NAVY REPORTS.—The annual reports of the Secretary of the Navy and of the chiefs of the various bureaus for 1911 have been issued. The report of the Bureau of Steam Engineering tells of the work which has been accomplished during the year in wireless telegraphy. It is expected that the high-power station being erected at Fort Myer, Va., will be in operation by July 1, 1912.

MARYLAND COMMISSION REPORT.—The Public Service Commission of Maryland has set a record by the prompt appearance of its report for 1911. With the report are found five appendices containing the opinions and orders of the Commission, a financial statement, tables of statistics from the annual reports of corporations, summaries of meter tests and accidents. The report of D. C. and Wm. B. Jackson on telephone rates in Baltimore is also included.

REPORT OF THE ELECTRICAL COMMISSIONERS OF SOUTH NORWALK.—The nineteenth annual report of the Board of Electrical Commissioners of South Norwalk, Conn., has been published. This report is worthy of the closest attention of central-station managers and municipal authorities. The South Norwalk plant is an example for municipal undertakings anywhere and under the direction of Albert E. Winchester, general superintendent and electrical engineer, it has been carried forward for almost a score of years in the most satisfactory fashion.

FINANCIAL NOTES.

The general character of the stock market last week was more uninteresting than at any time thus far during the year. There were few if any important changes and no sensational news. On the whole the market presented a firmer undertone. Foreign trade is keeping up well and the January record is not very far behind that for the same month last year, although the price for staples forming a large part of the shipments abroad has declined.

Bell telephone companies in eleven Middle Western States, with a combined capital exceeding $100,000,000, were united on February 20 in St. Louis at the annual stockholders' meeting of the Bell Telephone Company of Missouri. Officials of telephone companies in the eleven states were elected to the Bell of Missouri directorate to succeed five St. Louis men, who recently capitulated to the domination of the American Telegraph & Telephone Company, which is the parent concern.

The annual meeting of the Kings County Electric Light & Power Company will be held February 26. Stock of record February 26 may vote.

The annual meeting of the American Cities Company will be held March 5. Stock of record February 14 may vote.

The Cedar Rapids Manufacturing & Power Company, a recently organized Canadian company, will shortly sell $5,000,000 in bonds.

The annual meeting of the American Light & Traction Company will be held in Jersey City March 18 at 11 o'clock. Books close February 27 and reopen February 29.

Speyer & Company have contracted with the city of Los Angeles, Cal., to purchase $9,390,000 city of Los Angeles four and one-half per cent bonds, of which $3,500,000 are electric plant bonds.

F. A. Vanderlip, president of the National City Bank, New York, has been elected a director of the New York Edison Company, succeeding Judge Beardsley, of Beardsley & Hemmens, counsel for the company.

The annual statement of the Crocker-Wheeler Company, of Ampere, N. J., which has of late years entered the field of larger and heavier classes of electrical construction, shows a net income for the year ended December 31, 1911, of $230,166. There was an increase in surplus of $12,579.

The reorganization plan of the Chicago & Milwaukee Electric Railroad provides for an issue of $4,500,000 first mortgage five-per-cent bonds at the start, out of an authorized issue of $10,000,000. Based on the operating results of the receiver in 1911, the net earnings will be sufficient to pay the interest charges on the first fives.

The Federal Light & Traction Company has authorized an issue of $50,000,000 of five-per-cent thirty-year bonds for improvements, additions, etc., of which $5,000,000 is to be issued at once. The remainder will be reserved for future financing needs. The company has disposed of $3,000,000 of the new issue to bankers, besides $1,500,000 of six-per-cent ten-year debentures. The proceeds will be used to meet maturing obligations, provide immediate improvements, and retire all outstanding bonds, except $2,000,000 Springfield Railway and Light bonds.

Dividends.

American Railways Company has declared the regular quarterly dividend of 1.5 per cent, payable March 15 to stock of record March 1.

Chicago Elevated Railways; quarterly preferred dividend of 1.5 per cent, payable March 1 to stock of record February 23.

Chippewa Valley Railway, Light & Power Company; quarterly preferred dividend of 1.75 per cent per share, payable March 1 to stock of record February 29.

Columbus Railway Company; quarterly common dividend of 1.25 per cent, payable March 1 to stock of record February 15.

General Electric Company; regular quarterly dividend of two per cent, payable April 15 to stock of record March 2.

Kings County Electric Light & Power Company; regular quarterly dividend of two per cent, payable March 1 to stock of record February 16.

Northern Ohio Traction & Light Company; quarterly common dividend of one per cent, payable March 15 to stock of record February 29.

St. Joseph Railway, Light, Heat & Power Company; quarterly common dividend of 0.5 per cent, payable March 1 to stock of record February 15.

Reports of Earnings.

The West Penn Traction has issued its report for the year ended December 31, 1911. The income account compares as follows:

	1911	1910
Gross revenue	$2,260,287	$2,107,002
Operating expenses and taxes	1,112,281	987,642
Net revenue	1,148,005	1,119,360
Fixed charges, etc.	665,776	673,004
Surplus	482,230	446,356
Preferred dividends	97,500	97,500
Balance*	384,730	348,856
Common dividends	260,000	65,000
Year surplus	124,730	283,856

*Equal to 5.92 per cent earned on $6,500,000 common stock, as compared with 5.37 per cent earned on same stock previous year.

NEBRASKA TELEPHONE COMPANY.

The Nebraska Telephone Company reports for the year ended December 31, 1911, compare as follows:

	1911	1910
Gross	$2,245,506	$2,143,452
Expenses	1,741,140	1,717,434
Net	504,366	426,018
Interest	147,806	55,000
Surplus	356,560,	371,018
Dividends	281,220	280,854
Surplus	75,340	90,164

FEDERAL LIGHT & TRACTION.

Consolidated statement of earnings of subsidiary companies of the Federal Light & Traction Company for the month of December, 1911, and for twelve months ending December 31, 1911 (partly estimated), compares with earnings of same companies in 1910 as follows:

	1911	1910
December gross	$ 158,177	$ 145,795
Operating expenses	86,764	78,386
Net	71,413	67,409
Twelve months gross	1,335,272	1,221,737
Operating expenses	782,404	700,646
Twelve months net	552,867	521,091

Earnings of the Trinidad Electric Transmission, Railway & Gas Company, which began operations September 1, 1911, are included in earnings for the month of December, but not in the statement covering 12 months.

KING'S COUNTY ELECTRIC LIGHT & POWER COMPANY.

The annual report of the Kings County Electric Light & Power Company, covering operations for the year 1911, shows an increase in gross earnings of $459,220. Operating expenses were larger by $255,322. This reduced the gain in net earnings to $103,898. The surplus, which is arrived at after deducting all charges, including depreciation, reserve items, interest charges and dividends, is $178,682, as compared with $171,062 for the year of 1910. The report concludes with a statement to the effect that "the outlook for continued growth of the company is promising and warrants confidence in the stability and future success of the company."

The income account compares with the previous year as follows:

	1911	Increase
Gross operating revenues	$4,707,914	$459,220
Oper. exps., taxes, etc.	1,942,777	207,905
Taxes	380,296	81,386
Depreciation	605,377	66,031
Total expenses	$2,928,450	$255,322
Net oper. revenues	$1,779,464	$103,898
Non-operating revenue	75,364	*14,877
Total income	$1,854,828	$ 89,020
Bond discount	20,269	.....
Balance	$1,834,559	$ 89,020
Fixed charges	810,202	73,897
Balance	$1,024,357	$ 15,124
Dividends	800,000	.....
Balance	$ 224,357	$ 15,124
Brooklyn Edison inv. fund	45,674	7,503
Surplus	$ 178,682	$ 7,620
Previous surplus (adj.)	1,421,294	176,174
P. and L. surplus	$1,599,977	$183,794

*Decrease.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 19.	Feb. 12.
Allis-Chalmers common (New York)	¾	1
Allis-Chalmers preferred (New York)	5½	7
American Tel. & Tel. (New York)	141	140¼
General Electric (New York)	157½	156
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	82¼	79
Postal Telegraph and Cables preferred (New York)	69½	69
Western Union (New York)	83⅞	84⅛
Westinghouse common (New York)	70½	70½
Westinghouse preferred (New York)	*114	*114
Edison Electric Illuminating (Boston)	298	298
Massachusetts Electric common (Boston)	20	20
Massachusetts Electric preferred (Boston)	93½	93¾
New England Telephone (Boston)	159½	159
Electric Company of America (Philadelphia)	11⅞	11⅞
Electric Storage Battery common (Philadelphia)	54¾	54
Electric Storage Battery preferred (Philadelphia)	54¾	54
Philadelphia Electric (Philadelphia)	18½	18⅛
Chicago Telephone (Chicago)	139	139
Commonwealth Edison (Chicago)	139½	139
National Carbon common (Chicago)	100	105
National Carbon preferred (Chicago)	116	114

*Last price quoted.

PERSONAL MENTION.

J. W. CHAMBER, of Mangum, Okla., has been named as manager of the Duncan Electric and Ice Company, succeeding J. D. Hix, resigned.

A. W. BULLARD, Boston, Mass., has been appointed active vice-president of the Great Western Power Company, with headquarters at San Francisco, Cal.

MORTIMER FLEISHHACKER, San Francisco, Cal., has been selected as president of the Great Western Power Company to succeed Edwin Hawley, deceased.

HUBERT E. COLLINS, secretary of the Institute of Operating Engineers, has started for Brazil upon an extended trip in a consulting capacity for J. G. White & Company.

CARL HERING was granted the honorary degree of Doctor of Science at the University Day exercises of the University of Pennsylvania on February 22. He took his bachelor's degree at the same institution in 1880.

LEO C. HARMON, president of the Menominee Electrical Company, Menominee, Mich., has disposed of his interest in that company, and after a trip to Japan will take up business interests elsewhere.

PAUL M. LINCOLN has been selected by the American Institute of Electrical Engineers as its representative to be present at a celebration by the University of Pittsburgh of its 125th anniversary on February 27, 28 and 29.

W. A. MILROY has purchased a controlling interest in the light and power plant in Hopkinton, Iowa. Mr. Milroy recently returned from the Northwest, where he had been engaged in electrical work for a large number of different concerns.

S. S. SCOTT and H. ROSE have formed The Scott-Rose Company with offices at 1651 Marquette Building, Chicago, Ill. The company will act in an engineering capacity to serve clients in all forms of engineering work, including electrical engineering.

HARRY E. EICHHORN, Columbus, O., has been appointed superintendent of the division of electricity to succeed Wirt S. Scott. Mr. Eichhorn, who will have entire charge of the municipal light plant and lighting system of the City, for some time has been chief engineer in charge of the power plant at the Union Station.

PHILIP D. LAIRD, chairman of the Maryland Public Service Commission, left Baltimore on February 20, for a trip South. Mr. Laird has been confined to his home for several weeks with a mild attack of pneumonia, and his physicians have ordered him to a milder climate for the remainder of the winter. He appeared at the offices of the Commission one day last week for the first time in about six weeks and received the congratulations of his associates on his recovery. He wrote a letter to Governor Goldsborough acquainting him with the necessity of being away for about six weeks longer and stating that he did not desire to go away without notifying the Governor of his intention and receiving his approval. Governor Goldsborough wrote him immediately, expressing the greatest concern for Mr. Laird's health and urging him to go at once.

NEW INCORPORATIONS.

ST. JOSEPH, MO.—The St. Joseph Electrical Company has been incorporated with a capital stock of $7,500. The incorporators are E. J. Kerley, A. F. Fraulhaber, F. X. Andriana and others.

NEW YORK, N. Y.—Electrical Heating Apparatus Company has been incorporated with a capital stock of $1,000. August Eimer, Alfred L. Rose and Walter R. Eimer are the incorporators.

BUFFALO, N. Y.—Interurban Electric Light & Power Company has been incorporated with a capital stock of $50,000. Alexander G. Hoefler, Frank W. Tracy and Albert Dodge are the incorporators.

OWENSVILLE, IND.—The Owensville Water, Light, Power & Heat Company has been incorporated with a capital stock of $25,000. The directors are C. B. Smith, J. B. Beresford and G. R. Welborn.

FORT BRANCH, IND. — Fort Branch Water, Light, Power & Heat Company has been incorporated with a capital stock of $25,000. The directors are W. L. Walters, S. R. Lockwood and J. E. Topps.

MANHATTAN, N. Y.—The Motor Installation Company has been incorporated with a capital stock of $30,000. Lucius E. Judson, New York; Nathaniel M. Brown and Richard J. Kent, Brooklyn, are the incorporators.

MANHATTAN, N. Y. — Haskell Electric Contracting Company has been incorporated with a capital stock of $5,000. Birdie Haskell, Herman Haskell and Charles S. Sinsheimer, New York City, are the incorporators.

CHICAGO, ILL. — The Sidney-Mitchell Illuminating Company has been incorporated with a capital stock of $7,500 to manufacture lighting fixtures. The incorporators are Earl N. Mitchell, Thomas H. Sidley and Ivor Jefferys. Z.

NEW YORK, N. Y.—Koerting & Mathieson Company has been incorporated with a capital stock of $25,000 to manufacture electrical goods and supplies. Hans R. Boker, Herbert Ryan and James L. Suydam, New York, are the incorporators.

NEW YORK, N. Y.—Reese Supply Company has been incorporated with a capital stock of $10,000 by Llewellyn Reese, Stamford, Conn.; Montague Lee, Brooklyn, N. Y.; and H. H. Boyesen, New York City. The company will deal in electric light fixtures.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.)

No. 7862. MUNICIPAL TELEPHONE PLANT.—A report from an American consular officer calls attention to the opportunity which is likely to be found in his district for the sale of a municipal telephone plant, due to the increase in rates by the present telephone system in operation. The matter of a new system has already been considered, and it is likely to be brought up for further discussion and action shortly. The report states that in the meantime it might be well for American manufacturers of telephone instruments and systems to communicate with the mayor of the city in question. Further details of the report can be obtained from the Bureau of Manufactures.

NO. 8031. ELECTRICITY WORKS EXTENSION.—Bids are invited for the extension of the electricity works, Dartford, Kent, England, in accordance with plans and specifications which may be seen upon personal application at the office of the surveyor, council offices, Dartford, Kent. Tenders, indorsed "Extension of Electricity Works," must be delivered to W. Kay, clerk, council offices, Dartford, Kent, England, by Feb. 27.

NO. 8042. ELECTRIC CRANE.—Tenders are invited by the roads and bridges department, Brussels, Belgium, for the supply and installation of one 40-ton electric crane for Ostend Harbor. A provisional deposit of $1,946 will be required. Particulars, conditions of contract, and specification No. 155 may be obtained of the Roads and Bridges Department, Brussels, Belgium. Public adjudication, March 1, 1912.

NO. 8043. TELEPHONE EXCHANGES.—The Post and Telegraph Department, Belgium, contemplates the equipment of four new telephone exchanges. Specification No. 1191, may be obtained of the Post and Telegraph Department, Brussels, Belgium.

DATES AHEAD.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., March 21-22.

Northwestern Electric Show. Minneapolis, Minn., March 16-23.

National Railway Appliances Association, Inc., Chicago, Ill., March 18-23.

American Railway Engineering and Maintenance of Way Association. Chicago, Ill., March 19-21.

Minnesota Electrical Association, Minneapolis, Minn., March 20-22.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society. Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, Iowa, April 24-25.

Iowa Street and Interurban Railway Association. Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

National Electric Light Association. Annual convention, Seattle, June 10-14.

Michigan Section of the National Electric Light Association. Annual convention, on board the Majestic, sailing from Port Huron, Mich., about June 21.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., June 17-20.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

With the Electrical Manufacturers

The Everstick Anchor Company, 1622 North Eighth Street, St. Louis, Mo., has prepared a new circular concerning its Everstick anchor for pole-line guys and strains. The best sizes for various strains are given and a long list of companies using these anchors.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has secured orders from the Philadelphia Rapid Transit Company, Philadelphia, Pa., and the International Railway Company, Buffalo, N. Y., for 500 complete car equipments, each including two 50-horsepower interpole railway motors, type K-36 controllers and car-type circuit-breakers.

The Watson-Stillman Company, manufacturer of hydraulic machinery, with a plant at Aldens, N. Y., and general offices at 50 Church street, New York City, announces a reorganization. It is stated that the increasing use of hydraulic presses and the steady growth of the business necessitates an immediate extension of the company's manufacturing facilities. To take care of business increase it was considered advisable to reorganize the board of directors. The new officers elected are: Francis H. Stillman, president (re-elected); E. A. Stillman, vice-president; J. P. Bird, treasurer; A. F. Stillman, secretary and works manager, and Carl Wigtel, chief engineer.

The McGraw-Hill Book Company, 239 West Thirty-ninth Street, New York City, has completed arrangements for taking over the sales agency of the technical books of the *Railway Age Gazette*, the *American Engineer* and the *Signal Engineer*. This makes the Company publisher and distributer of books for the three journals, but it does not affect the publication of the papers themselves in any way. With the addition of these three papers in the railroad field, the Company now publishes books for twelve of the leading American engineering papers in the fields of civil, mechanical and electrical engineering, electric and steam railroading, machine tools, mining, metallurgy, chemical engineering, etc.

The General Electric Company, Schenectady, N. Y., has published bulletin No. 4906 devoted to the lighting of textile mills. This is a very handsome publication and illustrates in a most significant way the advantages of electric illumination for such mills. In addition to the descriptive matter there are a number of charts and schedules giving the textile-mill operator data which will enable him to figure very closely on his lighting, both from the seasonal and efficiency point of view. A particularly valuable feature of this bulletin is an analysis of the classes of service met with in textile lighting and the recommendations for proper illumination. This gives a graphic representation of the various processes and recommendations with respect to lamp and reflector and position of lamp.

The Independent Manufacturing Company, Milwaukee, Wis., has issued its 1912 catalog of electric controlling devices. This is a neatly prepared book and very easy of reference. Included in its 200 odd pages are illustrations and descriptions of motor starters of all types for direct-current or alternating-current circuits. Most of these are equipped with either hand or automatic no-voltage release and overload release. Controllers for regulating the speed of motors by either armature or field control, or both, are provided in many types. Drum-type controllers for heavy service, elevator controllers, field rheostats of all kinds, and many special control equipments are listed and described. For the smaller sizes all the controllers have their resistances wound on asbestos tubes arranged for air cooling. Cast-iron grids are used for all larger sizes.

Edwards & Company, Inc., 140th and Exterior Streets, New York, N. Y., have ready for distribution catalog No. 5, devoted to electrical house goods. This catalog gives a comprehensive illustrated and descriptive listing of annunciators, burglar-alarm apparatus, bells and gongs, fire-alarm apparatus, pushes, special signaling devices, door openers and latches, door switches and small switches. The listing of apparatus is supplemented by some interesting information giving wiring connections for signaling and alarm systems, closed-circuit fire-alarm systems, open-circuit fire-alarm systems, return-call annunciators, burglar alarms, wire tables and other useful data. An alphabetical index and a numerical index makes the discovery of material very easy. The company this year celebrates its fortieth anniversary, and the catalog is a handsome and useful souvenir of this occasion. This publication will be found very useful to everyone handling electrical supplies, and will be furnished to those interested upon request.

Record of Electrical Patents.

Issued by the United States Patent Office, February 13, 1912.

1,016,925. Outlet Box. A. I. Appleton, assignor to Chicago Fuse Manufacturing Co., Chicago, Ill. Consists of two sections whose sides are secured together by means of slotted lugs and screws.

1,016,936. Electrical Burglar Alarm. W. K. Cook, assignor to American Bank Protection Co., Minneapolis, Minn. Includes a multitude of insulated wires in the walls and door of the vault, the closing of the circuit between which rings the alarm.

1,016,958. Method of Transporting Oil Long Distances. A. E. Roberts, Sausalito, and Arthur L. Emery, Palo Alto, Cal. A number of pumping stations are located along the pipe line and between them are numerous points where the oil is electrically heated, all the pumping and heating stations receiving electrical energy from a central power station.

1,016,975. Block-Signal System for Electric Railways. S. S. Stolp, assignor of one-half to William J. C. Kenyon, Chicago, Ill. A system for intersecting tracks is operated through relays by approaching cars, each circuit including a permissive signal along one track and a warning signal along the cross track.

1,016,980. Controlling Device for Electric Motor Vehicles. E. W. Bender, Los Angeles, Cal. An alternating-current motor drives through a clutch a direct-current machine adapted to serve either as motor or dynamo, the controller and clutch for the latter machine being operated simultaneously.

1,017,005. Electrode or Pencil for the Arc Light. I. Ladoff, Cleveland, O., assignor of part to P. C. Peck, New York, N. Y. Composed of an alloy of titanium with other metal and potassium fluotitanate.

1,017,031. Process of Making Magnetic Pole-Pieces. O. Wingaard, assignor to Hoskins Manufacturing Co., Detroit, Mich. Consists in drilling a series of holes in an iron bar, filling them with brazing mixture and fusing it, removing iron between the holes and cutting the bar transversely.

1,017,034. Trolley Harp. South Bend, Ind. Has contact springs engaging the hub of the wheel and guards over the hub.

1,017,036. Wiring Tack. C. Blake, Brookline, Mass. The nail passes through a metal plate the ends of which are bent at right angles; within is an insulating lining forming a wire-receiving channel on each side of the nail.

1,017,051. Lamp Socket. J. M. Hall, Sulphur Springs, Tex. Consists of a driver inside which are resistance coils; a movable finger adjusts the

amount of resistance in series with the lamp.

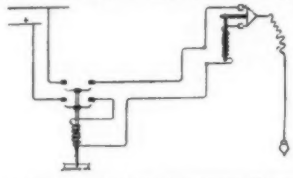
1,017,052. System of Electric Circuit Control. F. W. Harris, assignor to Westinghouse Electric & Manufacturing Co. The release magnet of a circuit-breaker is controlled by a time-limit relay.

1,017,054. Telegraph Sending Machine. J. A. Hulit, assignor to Hulit Transmitter Co., Topeka, Kans. Includes a motor and circuit-closer and keys for operating the latter.

1,017,056. Refining Machine for Coffee. H. L. Johnston, assignor to Hobart Electric Manufacturing Co., Troy, O. An electric motor drives a centrifugal separator and a blower for forcing out the dust.

1,017,060. System of Electric Current Distribution. C. M. Moss and S. Q. Hayes, assignors to Westinghouse Electric & Manufacturing Co. A circuit-breaker has closing and tripping magnets selectively controlled by a master switch, a series relay controlling the tripping magnet independently and preventing closure of the circuit-breaker until the master switch is in off position.

1,017,063. Electric Jacquard Apparatus. A. Regal, Vienna, Austria-Hungary. Has a number of cross wires beneath which are electromagnets.



1,017,110.—Lock for Battery-Charging Plug.

1,017,064. Galvanic Battery. E. C. Smith and E. L. Marshall, assignors to National Carbon Co., Cleveland, O. A primary battery with copper oxide electrode at the bottom and a zinc plate above in an alkali solution.

1,017,071. Armature for Dynamo-Electric Machines. J. Bache-Wiig, assignor to Westinghouse Electric & Manufacturing Co. Relates to the arrangement of the end connectors of the coils.

1,017,072. Machine for Manufacturing Parts of Incandescent Lamps. G. W. Beadle, assignor to Westinghouse Lamp Co. A machine for shaping and cutting off wire has a reciprocating carriage with feed rolls and a knife.

1,017,080. Storage Battery. J. P. Clare, Stratham, N. H. Has porous plates with their edges formed to present an abrupt edge between the electrodes.

1,017,082. Prepayment Meter. F. Conrad, assignor to Westinghouse Electric & Manufacturing Co. Relates to the arrangement of the coin wheel, coin chute and associated mechanism.

1,017,085. Telephone System. F. M. Davis, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Includes answering and multiple jacks and both local-battery and central-energy cord circuits.

1,017,101. Automatic Bell Switch. A. F. Kaiser, Detroit, Mich. A swinging door is provided with contact plates for automatically closing the bell circuit.

1,017,110. Lock for Electric Plugs. E. E. Rogers, assignor to Foster Engineering Co., London, Eng. A battery-charging plug is retained in position (as long as current flows) by the core of a solenoid projected through a hole in the plug stem.

1,017,122. Electric Locomotive. J. E. Webster, assignor to Westinghouse Electric & Manufacturing Co. The rotor of the motor surrounds and is flexibly connected to the driving axle; the stator is yieldingly mounted in the truck.

1,017,150. Controller for Electric Cranes. E. M. Holme, Stockport, England. Includes a set of electromagnetic switches controlled from a distant, portable, reversing master switch.

1,017,169. Method of and Apparatus for Transmiting Signals over Telegraphic Circuits. L. M. Potts, assignor to A. McLanahan, Baltimore, Md. Consists in automatically sending from a repeater a distinctive signal wherever synchronism is interrupted.

1,017,173.—"Slip-on" Lamp Shade.

1,017,172. Electric Advertising and Signaling Device. W. S. Ryan, assignor to L. Hengerer, New York, N. Y. Relates to the method of mounting contact-sweeping brushes on insulators.

1,017,173. Electric Light Attachment. W. S. Ryan, assignor to L. Hengerer, New York, N. Y. A lamp shade made of a glass cup with spring clips for engaging a lamp bulb.

1,017,198. Electric Motor Vehicle. E. W. Bender, Los Angeles, Cal. Has a sectionalized storage battery, a controller for grouping the sections in various ways, a motor-generator and a controller for the same to connect its windings in series or parallel to the battery controller.

1,017,208. Electric Track-Sweeper. A. M. Gardner, Indianapolis, Ind. The sweeper is adjustably mounted on the car and is chain-driven by a special motor.

1,017,226. Device for Indicating the Intended Movements of Vehicles. G. S. Matthews, Kansas City, Mo. Includes two differently colored lamps in the opposite ends of a central block.

1,017,232. Mechanism for Manufacturing Electric Conduits. R. C. Rahm, assignor to American Conduit Manufacturing Co., Pittsburgh, Pa. A tube-forming machine consists of strip-feeding and strip-forming mechanisms, tube-winding mechanism and take-off mechanism.

1,017,246. Automatic Starter for Electric Motors. J. B. Calderwood, assignor to Allis-Chalmers Co. An automatic switch biased to open position is first moved further away from closing position and then to closing position.

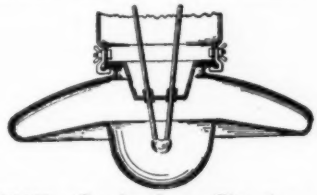
1,017,257. System of Motor Control. B. Frankenfield, assignor to Allis-Chalmers Co. and Bullock Electric Manufacturing Co. A motor-cooling system includes a main variable-speed motor partly ventilating itself and an auxiliary motor and fan whose speed is varied inversely to that of the main motor.

1,017,258. Ozonizing Apparatus. M. Fuss, Berlin, Germany. Consists of a transformer and a condenser, the latter acting as an ozonizer and being arranged about the high-tension transformer coil.

1,017,260. Electric Lamp Socket. J. H. Goehst, assignor to Federal Electric Co., Chicago, Ill. Includes a screw shell, an insulating block and a tubular insulating member.

1,017,263. Electric Illumination. I. Kitsee, Philadelphia, Pa. A luminous sign consists of a corrugated surface with bulb-like portions each containing a filament.

1,017,267. Electric Light Fixture. W. F. Overbagh, F. Overbagh, and I. H. Brent, assignors to Overbagh & Ayres Manufacturing Company, Chicago, Ill. An elongated tubular shell terminating at the bottom in a shade-holder contains a lamp socket that is adjustable longitudinally.



1,017,641.—Condensing Chamber for Flaming Arc Lamp.

1,017,270. Motor-Control System. E. W. Stull, assignor to Allis-Chalmers Co. A series-parallel controller with electromagnetic switches controlling the motor connections and the disposition of three sets of resistance.

1,017,280. Process of Increasing the Ductility of Metallic Tungsten. W. von Bolton, assignor to general Electric Co. Consists in treating tungsten at high temperature with hydrogen and protochloride of sulphur, then passing an electric current through the mass in an inert atmosphere and thereby expelling the sulphur.

1,017,285. Rail Bond. J. T. Deviese, Hilltop, W. Va., assignor of part to W. E. Deegans, Glen Jean, W. Va., L. P. Johnson, Lafollette, Tenn., and W. S. Johnson, Mount Hope, W. Va. Two bolts passing through the fish plates and web of the rail have openings in their heads for a flexible copper cable.

1,017,300. Single-Spark Ignition System. E. S. Lincoln, Brookline, Mass., assignor to Electric Goods Manufacturing Co. Includes a battery, an induction coil, an interrupter, a condenser, a distributer and timer.

1,017,304. Interrupter for Ignition Dynamos. C. T. Mason, Sumter, S. C. Included in a casing is a set of

contacts, a spring contact lever and an actuating cam.

1,017,308. Lightning Conductor. M. G. Mitchell, assignor to National Cable & Manufacturing Co., Niles, Mich. Consists of a bracket with lugs for attachment to a roof, a long point pivoted thereto so it may be plumb, and a conductor leading to ground.

1,017,309. Brush-Holder. S. H. Mortensen, assignor to Allis-Chalmers Co. Has an independent yoke for each brush group, a ring supported by this yoke and brush-holders supported by brackets.

1,017,311. Insulated Joint for Railroad Rails. T. O'Brien, Philadelphia, Pa. The base plate has a recess for an insulating plate and the side flange bars are insulated from the rail.

1,017,348. Reactance Coil. T. E. Murray and P. Torchio, New York, N. Y. A power-limiting reactance with its conductor imbedded to form flat spirals superposed in a refractory structure.

1,017,362. Sanitary Protector for Telephone Transmitters. C. Adams, New York, N. Y. A thin cup-shaped protector fits within and around the mouthpiece.

1,017,368. Coupling for Electric Fixtures. J. T. Bartley, Jersey City, N. J. A ball and socket joint to permit the fixture to hang plumb.

1,017,398. Telegraph Key. J. E. Folsom, St. Louis, Mo. The key bar is normally and adjustably held in contact with a conductor in an open-ended frame.

1,017,404. Indicator for Street Cars. H. Gebhart, Dayton, O. A designation sign is electrically lighted from within

1,017,413. Electric Controller. J. P. Hayes, Pittsburgh, Pa. A reciprocating motor operates a reverser and controller for a mill motor.

1,017,454. Coin-Collector. P. E. Oswald, assignor to Western Electric Co., Chicago, Ill. The construction of the coin chute for a telephone toll box is described.

1,017,459. Electric Spark Plug for Combustion Engines. L. Podszus, Charlottenburg, Germany. Provides a rotary circulation of air around the electrode.

1,017,462. Frog for Trolleys. J. M. Premoshis, Forbes Road, Pa. Has a central and two diverging tongues and trolley-wire holders, all integral with the base.

1,017,474. High-Tension Magneto-Electric Apparatus. F. R. Simms, assignor to Simms Magneto Co., New York. The conductor from the high-tension terminal to the distributor passes through a protected glass tube.

1,017,483. Process of Making Molded Conductors. C. Van Brunt, assignor to General Electric Co. Consists in mixing carbonaceous material, pitch and sulphur, compacting the mixture and firing to a high temperature to carbonize the pitch.

1,017,497. Arc-Light Electrode. E. R. Berry, assignor to General Electric Co. Consists of 95.5 per cent of titanium carbide mixture and 4.5 per cent of chromium carbide.

1,017,510. Electric Motor. F. W. Casterline, Tipton, Ia. Has both the armature and field rotating in opposite directions and geared together.

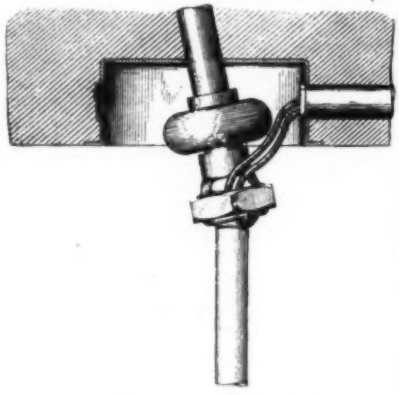
1,017,513. Electric-Alarm Mail Box. J. H. Corbett, Jr., assignor to E. M. Worden, Salem, Va. Within the box is a pendulum set in oscillation by the movement of the slot-closing plate and intermittently closing the alarm circuit.

1,017,527. Electric Line Switch. Frank Fisher, Reardan, Wash. An air-break high-tension switch with far swinging contact arm.

1,017,546. Filament Support. J. W. Howell, assignor to General Electric Co. A conductive strip embraces the filament, and a tantalum spring yieldingly presses it laterally against the strip and holds it in position by frictional engagement.

1,017,578. Irrigating Apparatus. W. P. McMillan, Tampa, Fla. A trussed spraying pipe is electrically moved back and forth along a pair of cables with limit control stops.

1,017,597. Magneto. J. E. Seeley, assignor to High Frequency Ignition Coil Co., Los Angeles, Cal. The



1,017,368.—Fixture Coupling.

armature core consists of H-shaped laminations.

1,017,604. Circuit-Closer. V. Tardieu Arles, France. Includes a number of contact blocks engaged by the contact lever; used in telephone substations.

1,017,614. Traveling Contact for Elevators. S. S. Williamson and B. Wilson, Philadelphia, Pa.; said Williamson asignor to said Wilson. Has a recess for a conducting cable and springs for electrically engaging the cable.

1,017,616. Telephone Repeating Appartus and Circuits. C. Adams-Randall, assignor to Randall Telephone Manufacturing Co., Augusta, Me. A repeater coil is in series with one side of the main line and a local repeating circuit is inductively related thereto.

1,017,617. Apparatus for Increasing the Efficiency of Telephone Lines. C. Adams-Randall, assignor to Randall Telephone Manufacturing Co. A repeater and local circuit is placed intermediate the ends of a long-distance circuit.

1,017,634. Means for Protecting Electrical Installations from Excess Voltages. G. Campos, Milan, Italy. A series transformer is connected in the line; its short-circuited secondary has a higher resistance and inductance than the primary.

1,017,641. Arc Lamp. T. L. Carbone, Charlottenburg, Germany. A flaming arc is inclosed by a concentric hemisporical glass globe over the open top of which is an enlarged metallic chamber for condensing the heated gases and fumes.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 19, 1912:

534,269. Electric Light Switch. Harry W. Lawrence, Denver, Colo.

534,281. Electric Current-Distributing System. Geo. B. Pennock, Boston, Mass.

534,288. Magneto-Electric Machine. Henry J. Smith, Pompton Lakes, N. J.

534,318. Electric Winding and Synchronizing Device for Clocks. Charles M. Crook, Chicago, Ill.

534,319. Electric Clock Synchronizer. Charles M. Crook, Chicago, Ill.

534,320. Electric Winding Mechanism for Clocks. Charles M. Crook, Chicago, Ill.

534,330. Electric Bell. William A. Harvey, Scranton, Pa.

534,359. Switch Device for Telephone Circuits. Chas. Clamond, Paris, France.

534,364. Signaling System. William E. Decrow, Boston, Mass.

534,373. Telephone and Signaling Circuit. Frank A. Pickernell, Newark, N. J.

534,374. Electrical Apparatus for Operating Dental Implements. Oscar H. Piefer and Alphonse F. Piefer, San Jose, Cal.

534,405. Electric Signaling Apparatus. Jonathan D. Price, Chiago, Ill.

534,421. Reflector for Arc Lamps. Carl Coerper, Cologne, Germany.

534,454 Conduit Electric Railway. Wilhelm Somon, Nuremburg, Germany.

534,475. Conduit Electric Railway System. William L. Heddenburg, New York, N. Y.

534,481. Electric Rotary and Revoluble Air-Circulating Fan. Sherman M. Pierce, Kansas City, Mo.

534,485. Electric Bell System for Street Railways. Edward L. Stansberry and Jacob Bettinger, St. Louis, Mo.

534,495. Conduit Electric Railway. Octavius Cohen, New York, N. Y.

534,519. Conduit Electric Railway. Alfred Rosenholz, San Francisco, Cal.

534,528. Electrical Brush. Anson L. Sonn, Lansingburg, N. Y.

534,529. Electric Brush. Anson L. Sonn, Lansingburg, N. Y.

534,536. Electrically Operated Dental Engine. William E. Wheeler, Dayton, Tenn.

534,547. Telephonic Apparatus. Norval L. Burchell, Washington, D. C.

534,586. Circuit-Making and Breaking Device. Samuel W. Stratton, Chicago, Ill.

534,595. Electrical Alarm or Bell. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J.

534,596. Electrical Conductor. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J.

534,597. Electrical Alarm for Street Cars. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J.

534,608, Tower Wagon for Electric Line Work. John R. Leonhardt, Baltimore, Md.